THE RÖNTGEN RAYS
IN THE DIAGNOSIS OF
DISEASES OF THE CHEST

SL. 616.24-073.75

THE RÖNTGEN RAYS

IN THE

DIAGNOSIS OF DISEASES OF THE CHEST

THE RÖNTGEN RAYS
IN THE DIAGNOSIS OF
DISEASES OF THE CHEST

BY

HUGH WALSHAM, M.A., M.D. CANTAB.
FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS
CHIEF ASSISTANT IN THE ELECTRICAL DEPARTMENT OF ST. BARTHOLOMEW'S HOSPITAL
SENIOR ASSISTANT PHYSICIAN TO THE CITY OF LONDON HOSPITAL FOR
DISEASES OF THE CHEST

AND

G. HARRISON ORTON, M.A., M.D. CANTAB.
ASSISTANT IN THE ELECTRICAL DEPARTMENT OF ST. BARTHOLOMEW'S HOSPITAL; MEDICAL
OFFICER IN CHARGE OF THE X-RAY DEPARTMENT OF THE NATIONAL HOSPITAL FOR
DISEASES OF THE HEART, AND OF THE CHEYNE HOSPITAL FOR SICK CHILDREN

WITH EIGHTEEN PLATES
AND TWENTY-TWO ILLUSTRATIONS IN THE TEXT

LONDON
H. K. LEWIS, 136, GOWER STREET, W.C.
1906

ROYAL COLLEGE OF PHYSICIANS
LIBRARY
CLASS 616.24-073.75
ACCN. 25383
SOURCE
DATE

PREFACE

THE increasing number of cases sent to the X-ray department for examination of the chest, and the numerous inquiries we have had of late from practitioners as to where some reliable information on this subject can be obtained, has led us to believe that a small book, giving a concise and as accurate an account as possible of our present knowledge of the subject, will supply a want, and, it is hoped, induce others to take an interest in a method of examination which is daily becoming more important.

It has been thought advisable to illustrate the book as far as possible with reproductions of skiagrams, rather than by drawings, as the former give a much more accurate idea of the appearances actually seen at the time of examination.

Great care has been taken in the production of the half-tone blocks, and they have been in no way retouched, but it is impossible by any method known at present to reproduce faithfully all the fine detail seen in a negative.

Our thanks are due to the publishers for the great care and trouble they have taken with the reproductions, to Mr. K. Schall, the Medical Supply Association, Messrs. Radiguet and Massiot, and Messrs. W. Watson and Sons, who have generously lent us blocks of instruments, etc., and to Mrs. W. J. Walsham for kindly reading through the proof-sheets.

HUGH WALSHAM,
G. HARRISON ORTON.

September 4, 1906.

Digitized by the Internet Archive
in 2015

https://archive.org/details/b2490787x

CONTENTS

CHAPTER PAGE

I. APPARATUS—METHOD OF EXAMINATION - - - 1

II. THE NORMAL CHEST - - - - - - 18

III. PULMONARY TUBERCULOSIS - - - - 26

IV. PLEURISY WITH EFFUSION - - - - - 39

V. PNEUMONIA—EMPHYSEMA—PNEUMOTHORAX—BRONCHITIS—ABSCESS OF LUNG—HYDATID OF LUNG—NEW GROWTH—CARCINOMA OF ŒSOPHAGUS - - - - 45

VI. THE HEART—PERICARDIAL EFFUSION - - - - 49

VII. THORACIC ANEURYSM - - - - - - 57

BIBLIOGRAPHY - - - - - - - 69

THE
RÖNTGEN RAYS IN THE DIAGNOSIS OF DISEASES OF THE CHEST

CHAPTER I

APPARATUS—METHOD OF EXAMINATION

THE brilliant discovery of Professor Conrad Röntgen, of Würzburg, towards the close of the year 1895, of a new form of radiation to which he gave the name of "X rays" has provided both the physician and surgeon with a new and valuable method of diagnosis. For some years past the surgeon has found these rays of special value as an aid to diagnosis in diseases and injuries of the osseous system, and in the detection and localization of various foreign bodies embedded in the tissues, but the physician has been slow to recognise their value as an aid to diagnosis in intrathoracic disease. It is with this branch of the subject that we propose to deal, and to endeavour to show that although still in its infancy, this comparatively new method may be of extreme importance in helping the physician to form a definite opinion in cases of doubt. It is a great advantage to be able to control one method by another. With the aid of the X rays we are enabled not only to do this, but, with the eye supporting the ear, we also control one sense by another; for to-day the eye can distinguish the position, shape, size, and movements of various viscera which were before invisible.

Historical.—A short historical note will, perhaps, not be out of place, as tending to show how slow the profession at large has been to recognise this important subject. In the month of August, 1896, or less than one year after Professor Röntgen had made public his remarkable discovery, MM. Oudin and Barthélemy, at the French Medical Congress held at Nancy, made known the fact that they had been able to observe, by means of the X rays, the beating of the heart, pulsations of the aorta, and the rise and fall of the diaphragm. On December 7 of the same year Professor Bouchard, in a communication to the Académie des Sciences (16), described cases of pleurisy studied by means of the Röntgen rays, and nine days later, in another communication, gave an account (17) of the rays as applied to the diagnosis of pulmonary tuberculosis; and in yet a third (18) on the 28th of the month, in which he dealt with intrathoracic disease in general, he remarked that the employment of the Röntgen rays, which had proved of such service to the surgeon, had become quite as precious to the physician. This was nearly ten years ago, and yet to-day the mass of practitioners in this country are quite ignorant of the value of the rays in the diagnosis of chest diseases.

Since that time important work has been done on this subject both in this country and abroad, the names of Béclère, Bergonie, and Bonnet Léon, of Paris; Francis Williams, of Boston; Crane, of Philadelphia; Mignon, of Nice; Holzknecht, of Vienna; Espino-y-Capo, of Madrid, being, perhaps, those best known among the earlier writers on the subject.

It is not intended to spend much time in discussing the nature of the rays, nor to give any long or detailed account of the apparatus necessary for their production; all this can be found well described in the various books which have been published on this subject.

Briefly, then, the essentials of an X-ray equipment are a Crookes tube and some form of tube-holder, a means of exciting this tube, a fluorescent screen, and for radiography, of course, the photographic plate.

The tube may be excited by means of:

The static machine;
Some form of high-tension transformer;
The Ruhmkorff coil.

The static machine is very susceptible to atmospheric changes, which makes it unsuitable for general use in this country.

The high-tension transformer is perhaps the best form of apparatus when the alternating mains only are available; the model introduced by Gaiffe, of Paris, is very convenient, but expensive, and essentially non-portable.

The coil is the form of apparatus most universally adopted in this country ; it is comparatively cheap, it is portable, practically uninfluenced by atmospheric changes, and excellent for radiography; while with a suitable interrupter, the fluorescence of the tube is almost as steady as in the case of the static machine.

All the skiagrams shown in this book have been taken with a tube excited with one of Leslie Miller's jointless section coils, and one capable of giving a full 12-inch spark. Much larger coils are sometimes recommended, but we do not consider that anything larger is necessary, as there is no tube that will stand the full output from such a coil for many minutes. Moreover, in chest work a tube of moderately low vacuum is required, for reasons that will be considered later.

To make a satisfactory examination of the chest, there are certain essential points to which attention must be paid, and which will necessitate certain special features in the apparatus employed.

(1) It is essential to have complete and rapid control over the quantity of rays emitted. It is also necessary to have some control over the quality of the rays.

(2) The radiation must be steady.

(3) An easy means of altering the relative position of tube, patient, and screen is indispensable.

(4) The luminous sensibility of the observer must be as great as possible.

We have found that a steady radiation, and one over which we have efficient control, can be obtained with the following combinations :

When the constant current from the mains is available, a Wehnelt interrupter (Fig. 1), worked through a shunt rheostat (Fig. 2), with an arrangement for varying the number of volts, is very satisfactory. With this arrangement we have complete control over the interrupter, and by merely turning the crank on the rheostat the amount of energy passing through the tube can be regulated to a nicety. This form of interrupter requires very little attention, and can be placed in another room or in a cellar ; thus there is an almost complete absence of noise, which is a great advantage when dealing with nervous patients. The chief disadvantages are the large amount of current consumed, and the unpleasant fumes given off.

Another very good break is the mercury jet interrupter ;

the form figured (Fig. 3) we have found very satisfactory when worked off the mains through a series resistance. The duration of contact can be altered by turning a lever, and by this means alone it is possible to vary the strength of current passing through the primary of the coil from 0·5 to 3 or 4 ampères. The strength of the current can further be controlled by varying the speed of the motor with a rheostat (not shown in the illustration) provided for this purpose, and, of course, by altering the resistance in the main circuit.

The new Gaiffe automotor mercury jet interrupter (Fig. 4) has many points in its favour: it is less than half the price of the other form, is simple, portable, and requires no independent motor. During the few months we have been using this interrupter it has given every satisfaction.

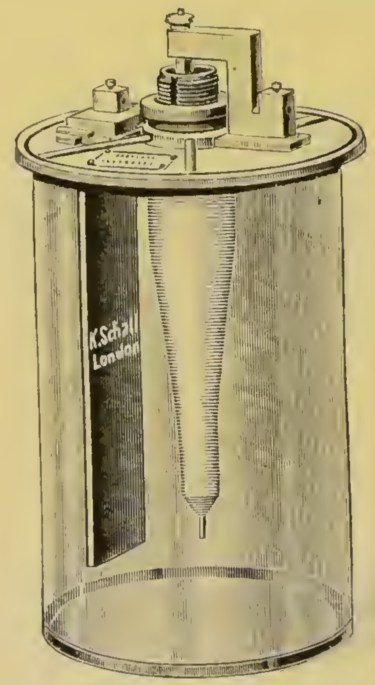


Fig. 1.—Wehnelt Interrupter.

The current used with the two latter interrupters is much less than in the case of the Wehnelt, but if much work is done the mercury soon becomes churned up into a kind of mud, which is somewhat troublesome to clean off; these interrupters are consequently more suitable for private than for hospital work. In the latter case we know of no break which gives less trouble than the Wehnelt, and we have tried a great number. Special forms of mercury interrupters can be obtained for use when the alternating mains alone are available (Fig. 5), but in this case the Wehnelt is not so satisfactory, as the platinum becomes eaten away very rapidly. It is possible that some form of high-tension transformer will under these circumstances be the most satisfactory apparatus to employ.

If the electric light mains are not available, accumulators giving from 16 to 24 volts will have to be employed, and in districts where these cannot be easily recharged a dynamo and small gas-engine will be the most satisfactory method of generating the current.

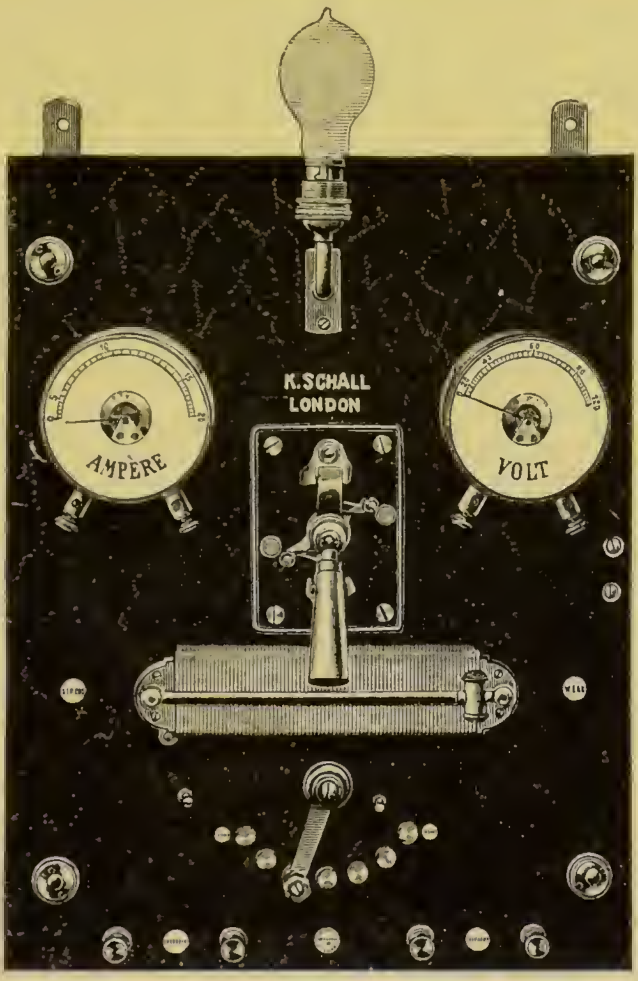


FIG. 2.—SHUNT RHEOSTAT.

With a crank to vary the number of volts of the main and small sliding rheostat to vary the number of ampères.

In all cases where high voltages are employed on the primary of the coil the current induced at make is very considerable, and it will be necessary to use some form of high-tension rectifying apparatus for the purpose of cutting out as far as possible any impulses in the wrong direction from passing through the tube, as these are not required for the production of the rays, and only unduly raise the vacuum of the tube and produce secondary rays which tend to vitiate results, and upset the reading of the milliampèremeter.

The valve-tube of Villard is a very efficient rectifier, but the vacuum rises very rapidly when much work is done ; and we have found that the high-tension rectifier (Fig. 6) supplied by Watson, though not quite so efficient a rectifier as the Villard valve, is all that is requisite in practice. It retains a constant vacuum for a much longer period, and requires much less attention generally, which is a great advantage—at least, in hospital work. Another way of getting over the difficulty is to use one of the bi-cathodal tubes also supplied by Watson (Fig. 7). We have found these tubes fairly satisfactory, though somewhat cumbersome.

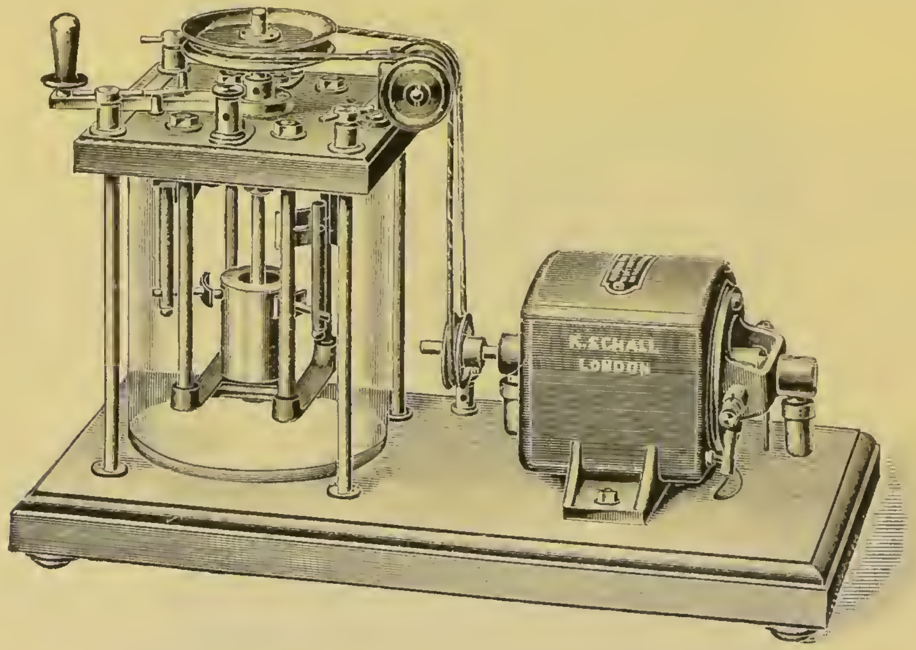


FIG. 3.—MERCURY JET (TURBINE) INTERRUPTER.

It stands to reason that rays of the same penetration are not suitable for all cases alike, and the power of penetration within certain limits must be increased according to the thickness and muscular development of the patient under examination.

Now, the same tube produces rays of more or less penetrative power according to its degree of electrical resistance, and this varies with the degree of vacuum within the tube. The higher the vacuum, the greater the resistance and the more penetrative the rays.

The resistance can be measured with a fair amount of precision by slowly approaching the two ends of the discharging rods of the coil—the tube, of course, being in circuit—until a spark just passes between the two. This occurs at the moment when the electrical resistance of the air-space which separates the terminals no longer exceeds that of the tube; it is known as the *equivalent spark*, the resistance offered by this stratum of air being equivalent to the resistance of the tube.

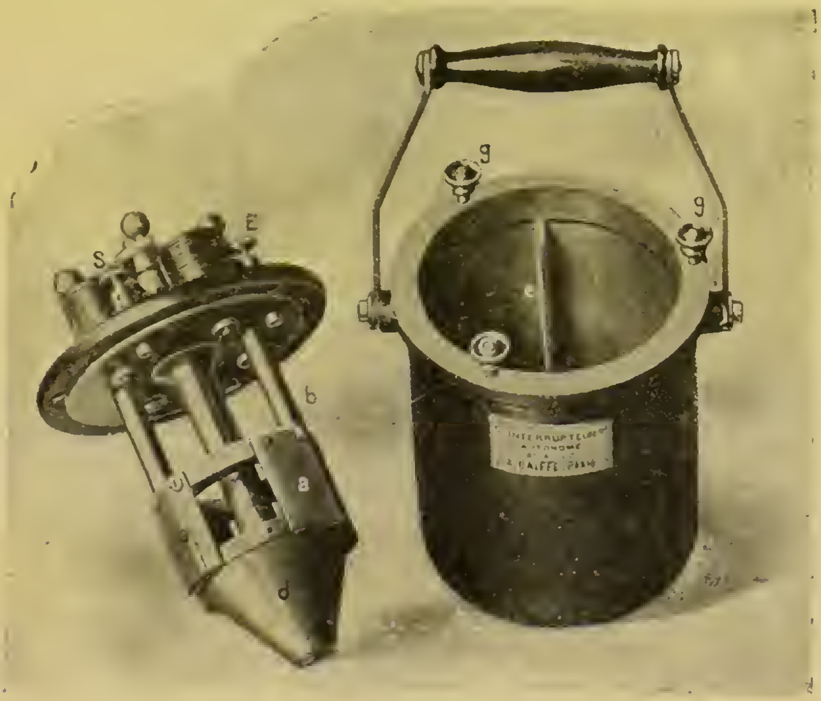


FIG. 4.—THE GAIFFE AUTOMOTOR MERCURY JET INTERRUPTER.

Since electrical discharges come off more readily from points than from flat or rounded surfaces, it will save trouble to have both extremities of the discharging rods pointed instead of the usual disc at one end, which is quite unnecessary. If the current be flowing from disc to point, the spark-gap will appear shorter than if it be flowing in the opposite direction, the difference in some instances amounting to as much as 1 or 2 inches, which makes it necessary to be sure that the current is always flowing from the pointed end to insure accurate comparisons. By having both ends pointed this error is obviated, and the direction in which the current is flowing is immaterial.

Useful information as to the resistance of the tube can also be obtained by means of the milliampèremeter; if the exciting current be kept constant, then any decrease in the vacuum of the tube is evidenced by an increase in the readings of the milliampèremeter, and *vice versâ*. From M. D'Arsonval's* experiments it would appear that for a tube of given vacuum the quantity of X rays emitted is proportional to the milliampèrage, and that for a given milliampèrage the increase in penetration of the

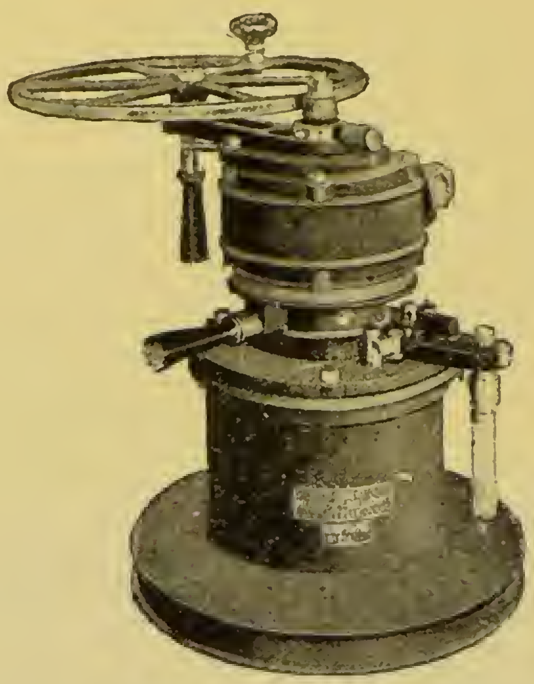


Fig. 5.—Mercury Jet Interrupter, with Synchronous Alternating Current Motor.

To use an *alternating* supply for working a spark coil.

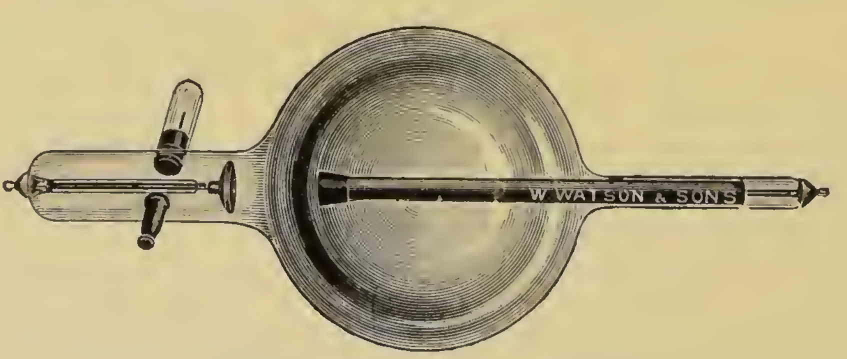


Fig. 6.—Watson's High-Tension Rectifier.

---

* *Comptes Rendus*, May 9, 1904.

X rays is proportional to the increase in the voltage. This holds good within certain limits, and we have found it fairly accurate if the equivalent spark-gap be not less than 1½ inches or greater than 4 inches. For use with a coil, the instrument supplied by Schall is satisfactory (Fig. 8). Gaiffe's instrument, except for use with the transformer, is somewhat cumbersome.

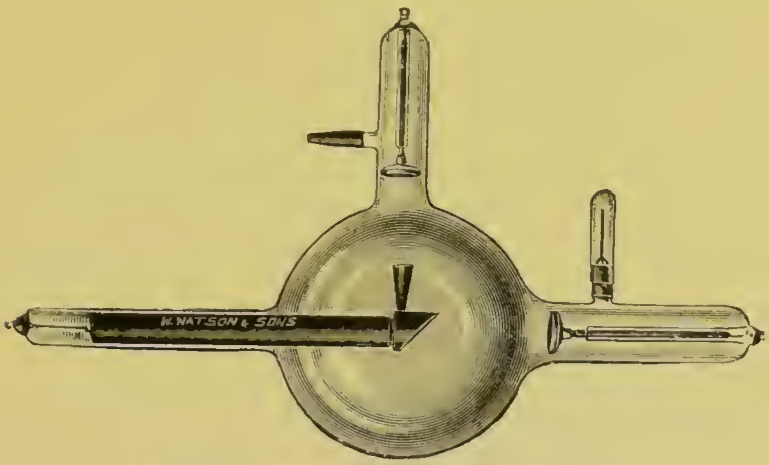


FIG. 7.—BI-CATHODAL TUBE.

This tube is provided with two cathodes; the cathode stream produced by one phase of the current impinges on the anticathode, and forms X rays. The cathode stream produced by the alternate phase is focussed in a concave funnel behind the anticathode, whence it is harmless, and offers an obstruction to that direction of current. A rectifier can therefore be dispensed with.

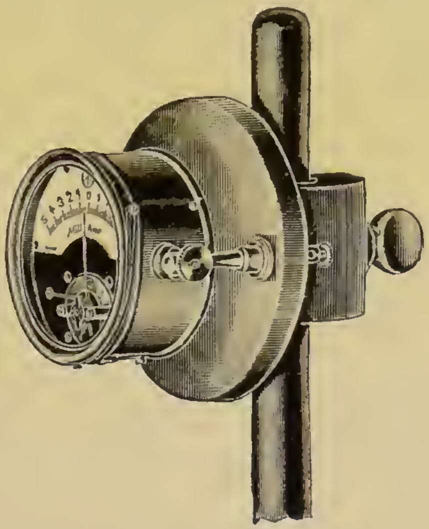


FIG. 8.—MILLIAMPÈREMETER FOR MEASURING THE CURRENT PASSING THROUGH AN X-RAY TUBE.

Such an instrument will be found useful for adjusting the tube for radiography. But for radioscopy, where all the work is done in absolute darkness, it is not required. In this case the radiochromometer of Benoist attached to the screen will be useful for testing the penetration at any given moment (Fig. 9).

It is evident, from what we have said, that only tubes provided with some regulating device are suitable for this work, and after trying various forms we have come to the conclusion that tubes provided with what is known as the "Osmo regulator" are by far the most satisfactory. This device was invented by Villard, and consists of a small platinum capillary tube sealed into the X-ray tube, communicating with its interior at its open end and closed at its free end. The principle depends on a peculiarity of the metals, platinum, and palladium, discovered over thirty years ago by MM. Troost and Sainte Claire-Deville—namely, their permeability to hydrogen, and to hydrogen only, when red-hot. All that is required is to heat this capillary tube in a spirit flame, and it will allow some of the hydrogen from the flame to enter the X-ray tube, and so lower the vacuum. The vacuum can be raised to some extent by placing a metal collar over the platinum

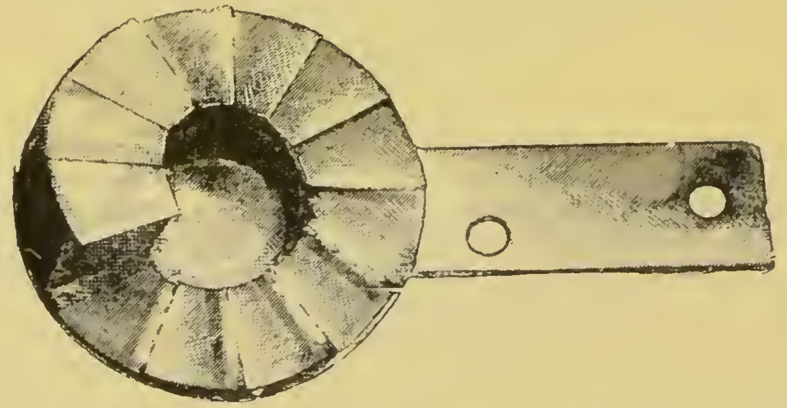


FIG. 9.—BENOIST'S RADIOCHROMOMETER.

This radiochromometer consists of a circular disc of aluminium in which steps of varying thickness are cut. In the centre is placed a disc of silver, which has the peculiarity of throwing on the fluorescent screen the same depth of shadow, whatever the penetration may be—that is, the shadow in the centre of the radiometer remains uniform. The shadow cast by the aluminium, however, changes according to the penetration of the tube. The step of aluminium casting the same depth of shadow as the silver denotes the degree of penetration of the tube.

or palladium tube to protect it from the gases of the flame, and then heating for some time. Under these conditions gas diffuses outwards from the interior of the X-ray tube. This operation is tedious, but is not so often required, as the tendency is for the vacuum to increase gradually.

In the German X-ray tubes the small capillary tube is made of palladium, and the merest touch of the flame is often sufficient to lower the vacuum. The tube we have found very satisfactory is one known as Gundelach's (Fig. 10); it is provided with a thin palladium tube for regenerating the vacuum, and has a heavy anode capable of standing very heavy discharges; the life of these tubes is longer than any other we have tried. Care must be taken to protect the little palladium tube, as it is very thin, and if bent much will crack and allow air to enter the X-ray tube, and so ruin it.

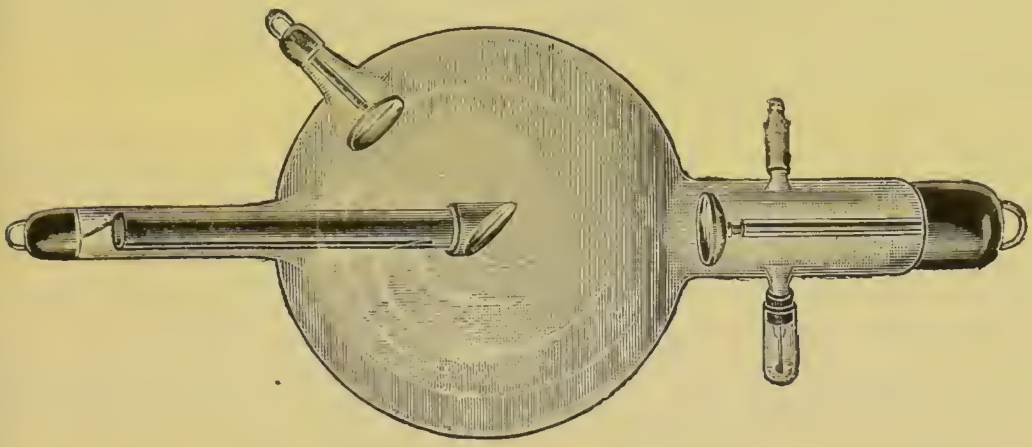


FIG. 10.—GUNDELACH'S TUBE.

The **position of the patient** under examination with the fluorescent screen should be one that can easily be changed, and one that will interfere as little as possible with the movements of respiration. The best position, then, is to examine the patient standing; if the condition of the patient does not admit of this, then he should be seated, and since in the ordinary sitting posture the movements of the diaphragm are apt to be interfered with, the best arrangement will be that adopted by Béclère, and consists of an ordinary music-stool, provided with a screw arrangement for adjusting the height, and with the top replaced by a bicycle saddle; this allows of almost complete extension of the thighs on the pelvis, and, further, the patient can easily be turned so as to admit of an examination from every point.

Finally, if the patient be very weak, he may be examined in the recumbent position, by using a couch with a canvas top with the tube below; this does not admit of much change in position of the patient, and should only be adopted in cases of necessity.

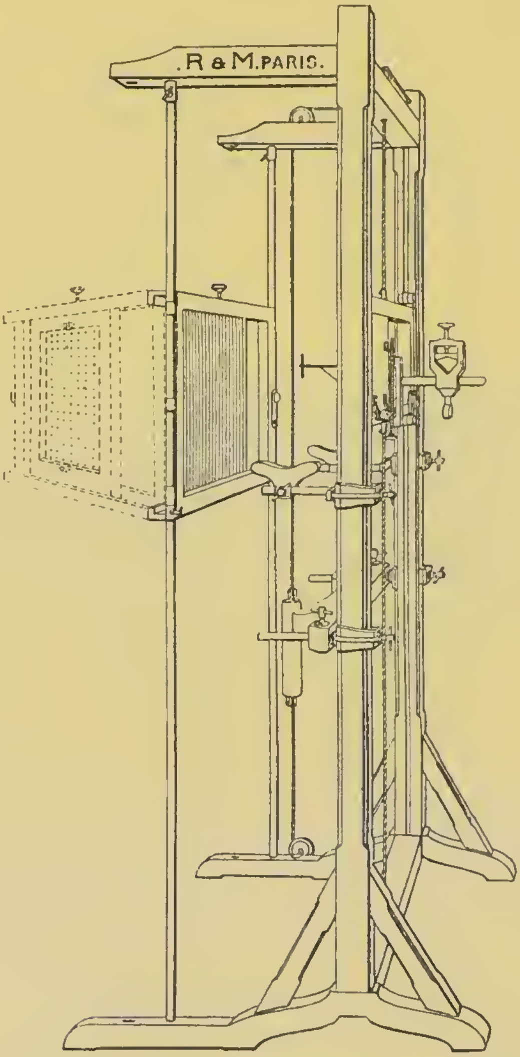


FIG. 11.—GUILLEMINOT'S CHÂSSIS,

Showing pulleys for moving the tube, method of fixing screen, and supports to secure immobility of the patient. The front cross of the "Radioguide" can also be seen.

The next important point is that the tube should be freely movable, and the support invented by Dr. Guilleminot, and manufactured by Radiguet and Massiot of Paris, will be found a very useful piece of apparatus. It consists essentially of a vertical "*châssis*" (Fig. 11), in which are two frames, sliding in grooves, one in a vertical and the other in a horizontal direction. The frames are moved by cords running over pulleys, thus permitting the focus-tube to be easily moved in all directions. It is also provided with a lead diaphragm, the aperture of which can be altered at will after the manner of an iris diaphragm. By limiting the illuminated surface of the screen with this device, the precision of the outlines and clearness of detail in the region more particularly examined are increased.

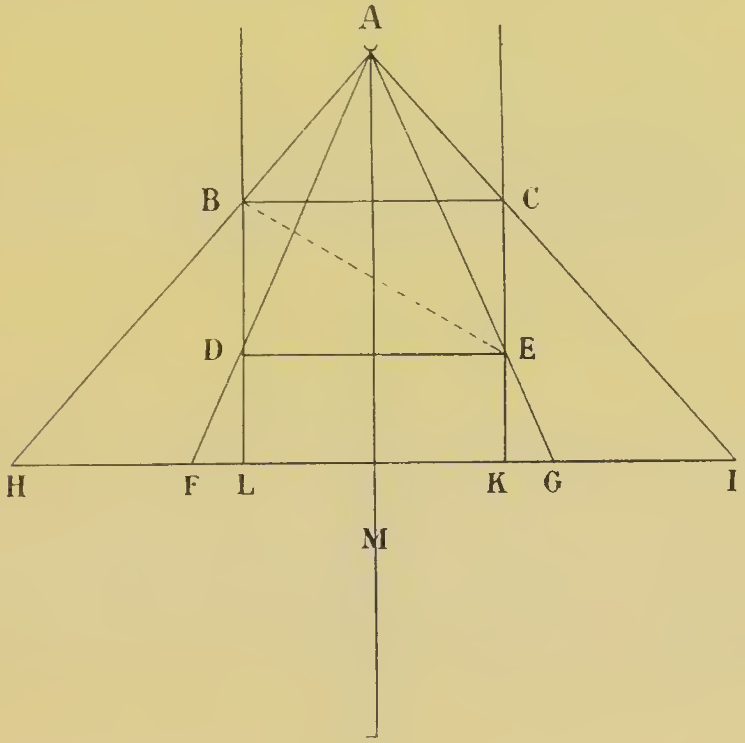


FIG. 12.

A, Anticathode; B C and D E, the same objects at different distances from A. F G is the image of D E, and H I that of B C, which is nearer to A than D E. K L, which is the same size as B C and D E, is the image which would be obtained if the projection were parallel. A M is the ray of "normal incidence."

Orthodiascopy.—It will here be necessary to point out the principles of what is known as orthodiascopy, a method of examination which is essential when accurate measurements of the size, say, of the heart or an aneurysmal sac are required.

When a source of light casts a shadow of an object on a plane surface, distinction has to be made between parallel and central projection: the sun is an instance of the former; the X rays fall into the latter category, and in this case the image must necessarily be larger than the object (see Fig. 12), the more so the nearer the object be to the source of light. The shadow of the heart, for instance, in the ordinary examination will be somewhat exaggerated, and the nearer the tube to the screen, the greater will be this exaggeration.

Now, in the diverging pencil of rays emitted by the anti-cathode, there is one which strikes the screen perpendicularly; this has been called the ray of normal incidence, or the normal ray, and the point on the screen on which this ray is cast the point of normal incidence. In orthodiascopy this normal or perpendicular ray is conducted around the entire circumference of the organ examined, and thus the exact size can be mapped out.

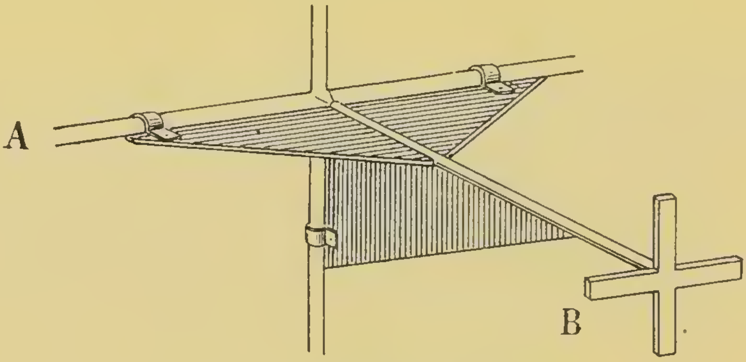


FIG. 13.—THE RADIOGUIDE.

A, A portion of the cross which remains in front of tube; B, the cross which is removed after the "normal ray" has been found.

This can be accomplished in several ways. An ingenious device which is used in conjunction with Guilleminot's stand briefly consists of the following: Two metal crosses (Fig. 13) are placed one behind the other in front of the tube, and parallel to the screen. The shadows of these two crosses will be merged into one when the "normal ray" passes through the two points of intersection of their branches. The position of the tube is now altered until the two crosses cast but one image on the screen, and is then fixed. The front cross is next removed, and the other remains fixed in front of the tube; this will cast a shadow on the screen, and the point of intersection of the branches of the cross will be the "point of normal incidence" on the screen. No matter, then, in what attitude the patient be examined, with this device we always have this point shown on the screen. The combination of the two crosses is called the " Radioguide."

Method of Procedure.—The patient is placed in front of the *châssis*, supported by rests attached to the frame, and the fluorescent screen adjusted to a suitable height.

By means of the cords the tube is moved so that the normal ray falls on the upper edge of the sternal notch, which is then marked on a piece of ground-glass fixed in front of the screen, to serve as a point of reference; this is important, as we are thus able to secure the immobility of the patient, and we also have a fixed point from which measurement may be taken. The tube is now displaced, so that the normal ray described the contour of the organ to be examined, a tracing being made

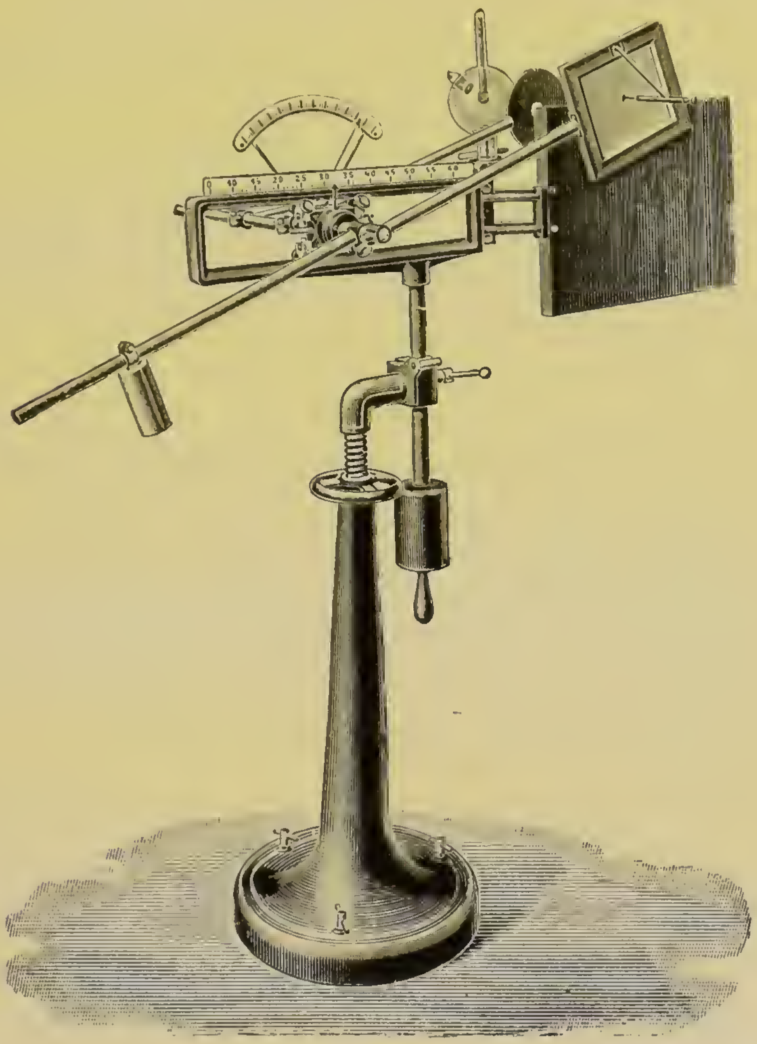


FIG. 14.—THE ORTHODIAGRAPH.

by hand at the same time on the glass, which can afterwards be transferred to tracing-paper.

Another piece of apparatus is that known as the orthodiagraph. With this instrument, by a system of articulated levers, the tube is made to follow exactly and easily the movements of the pencil which has previously been fixed opposite the anticathode. There are several models of this apparatus, which is used chiefly by German workers; Fig. 14 is perhaps the best form, and can be used both in the horizontal and vertical positions. A glance at Fig. 15 will explain the principle which underlies them all.

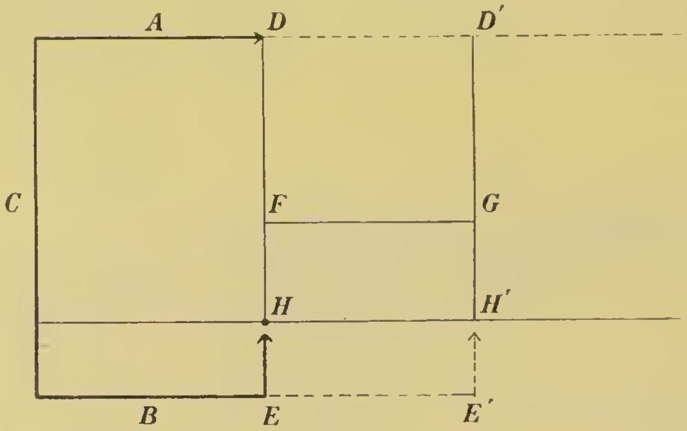


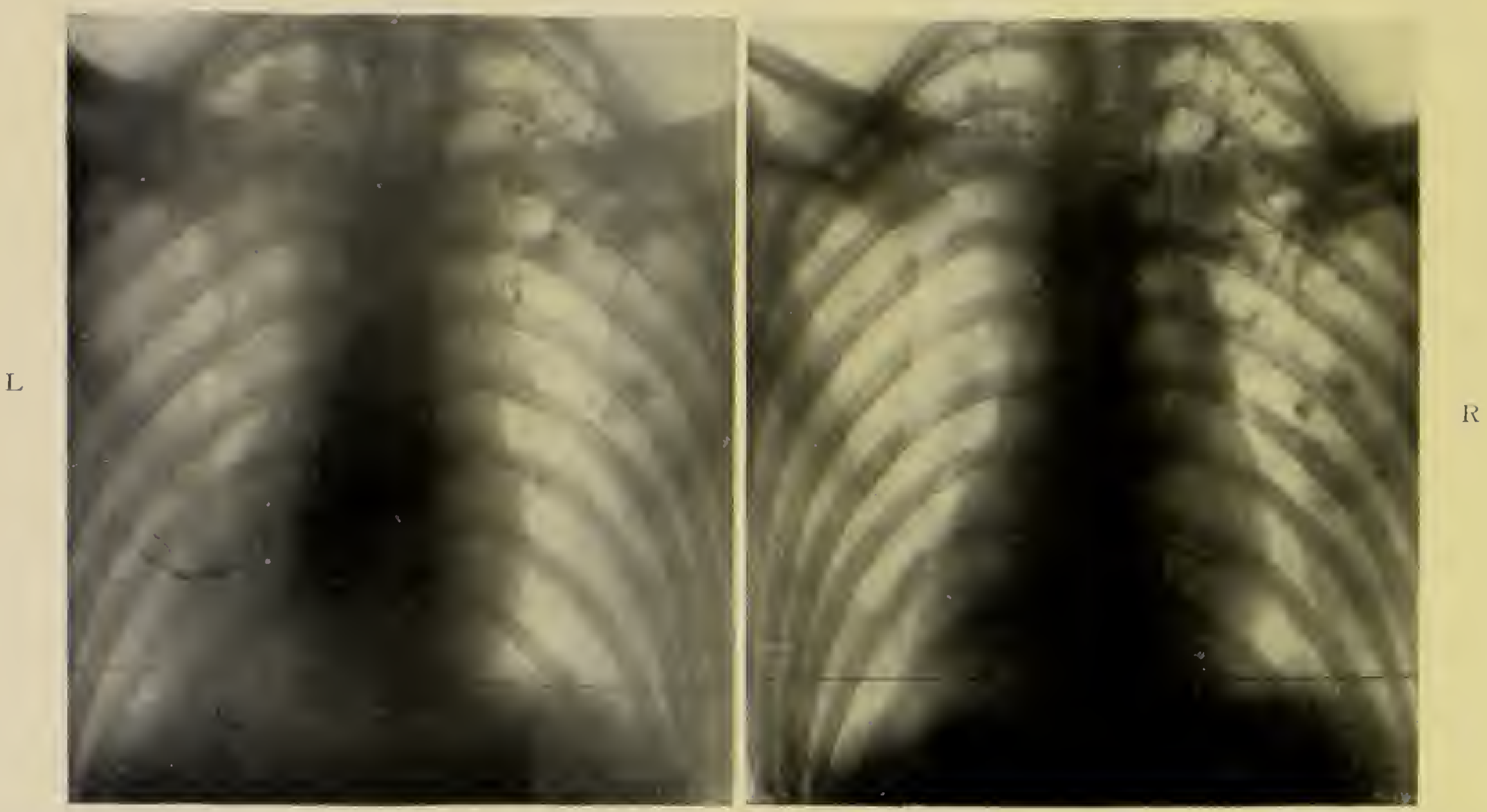
FIG. 15.

A is the bar supporting focus tube; *B* is the bar supporting the pencil; *C*, the bar connecting *A* and *B*; *D*, the anticathode; *E*, the pencil fixed opposite *D*; *F G*, the object to be measured. The ray of "normal incidence," *D H* (see also A M, Fig. 12), touches the left border of *F G*, and projects this spot on *H*, which is then marked with pencil *E*. *D* is now moved to *D'*, so that the normal ray *D' H'* touches the right border of *F G* at *G*, and projects this spot on *H'*, which is marked by the pencil *E'*. The image *H H'* is equal to *F G*. The line on which *H* and *H'* are marked by *E* represents, of course, the glass or paper on which the tracing is being made.

Stereoscopic radiography, by enabling us to obtain the third dimension in space, is in some cases of great service (see Plate I.). The method is simple, and can be carried out by means of a couch with a canvas top, with the tube either above or below the patient. It necessitates the use of two plates for each examination—an additional expense, which, when such large plates have to be employed, is against its general adoption in hospital work. Moreover, in the great majority of cases it is not needed for diagnosis.

The procedure is as follows: The patient is placed on the

PLATE I.



Calcified Miliary Tubercle of Both Lungs.

(Plate back of Chest.)

[*To face p.* 16.

couch; and under the part to be radiographed—or above it, if the tube be below—is placed a special plate-carrier, which enables the plates to be changed without disturbing the patient. The tube-carrier is made to slide in a groove, and is provided with a pointer which runs along a centimetre scale. The tube is then accurately centred over the part to be examined, moved 3 centimetres away from the middle line, and an exposure made. The plate is then removed, another put in its place, the tube removed 3 centimetres to the other side of the middle line, and another exposure made.

The negatives so obtained, suitably illuminated, are placed in a Wheatstone reflecting stereoscope. The results obtained in some cases are extremely beautiful.

An apparatus called a commutator for obtaining stereoscopic relief on the fluorescent screen has been brought out, but we have had no experience of its use. Attempts have also been made to show the movements of the heart, etc., by means of the cinematograph, but the apparatus necessary is expensive, and results so far have not come up to expectation.

The luminous sensibility of the observer plays an important part in radioscopy, and it is important to acquire as great a retinal sensibility to the fluorescence of the screen as possible. There is no doubt that the sensibility is greatest at night, but it is not possible for all examinations to be carried out at this time. The observer should therefore remain in absolute darkness for some little time before commencing a radioscopic examination. Béclère, who has made a special study of this point, says: "My own experimental observations (7) have proved by precise measurement that after ten minutes in the dark the sensibility of the retina to the light of the fluorescent screen has become fifty to one hundred times greater than it was on emerging from broad daylight; it is about two hundred times greater after twenty minutes' observation, and after a longer interval it still increases."

CHAPTER II

THE NORMAL CHEST

BEFORE giving an account of the various morbid conditions in which the rays may be advantageously employed as an aid to diagnosis, it will be necessary to describe in some detail the appearances which can be seen on the screen and on the photographic plate in the normal chest.

There are five chief positions which are employed when making a compete exploration of the chest with the X rays, and each has some special reason for its adoption. They have been named :

1. The anterior examination.
2. The posterior examination.
3. The right anterior oblique examination.
4. The left posterior oblique examination.
5. The left lateral examination.

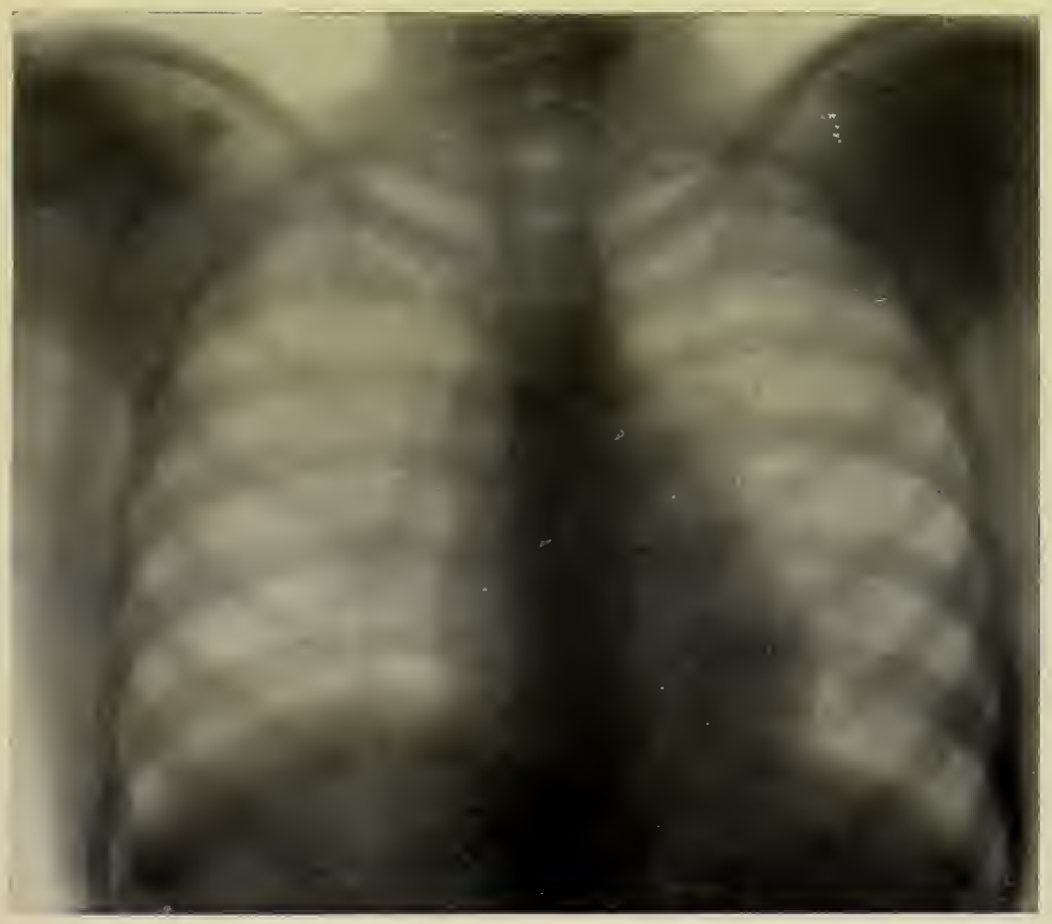
It will be necessary to describe the appearances seen in each.

1 and 2. **The Anterior and Posterior Examinations.**—These are the examinations most often adopted in this country, and nearly all published skiagrams of the chest have been taken in one of these positions. The examinations are carried out with the screen placed successively on the anterior and posterior surfaces of the chest, the tube, of course, being on the opposite side to the screen in all cases.

Now, the radioscopic image of the normal thorax examined with the screen either on the anterior or posterior surface of the chest presents three distinct vertically disposed zones, one median and two lateral (Plate II.).

The median zone is dark, and corresponds to the shadows cast by the vertebral column, the sternum, and the mediastinal contents, *i.e.*, the heart and great vessels. To take the mediastinal shadow in more detail : To the left of the dense

PLATE II.



Normal Chest.

Note lattice-work effect caused by the crossing of the ribs. (Plate front of Chest.)

[*To face p.* 18.

shadow cast by the spine is the shadow cast by the aorta above, and the shadow cast by the left ventricle below, while between these two are the shadows of the left auricle and pulmonary artery. To the right it is made up of the shadows of the vena cava superior above, and the right auricle below. Of these shadows, that part of the aorta which is not obscured by the spine, and the ventricles of the heart, are very distinct and easily separated from the others, the commencement of the descending aorta forming a distinct prominence which we have termed the left lateral aortic bulge; the auricles are less distinct: the shadows of the veins are very indefinite, and cannot be differentiated from the general shading.

The two lateral zones situated on each side of the central opacity are transparent and correspond to the two lungs; they are crossed by the curved shadows of the ribs, and above by the somewhat denser shadows of the clavicles.

These clear zones are bounded laterally by a dark line, formed by the shadows of the overlapping ribs and lateral walls of the thorax; superiorly, by the shadow of the first rib; while inferiorly they are limited on either side by a dark arching shadow with its convexity upwards, which rises and falls with the movements of respiration, and corresponds to the diaphragm.

The foregoing general description will apply in the main essentials, whether the examination be made with the screen on the anterior or posterior surface of the chest. But there are certain differences which it will be well now to point out.

With the screen on the anterior surface of the chest, the latticework effect, caused by the crossing of the ribs, is much more marked than when the screen is on the posterior surface (*cf.* Plates II. and VI.), due, no doubt, to the difference in structure between the anterior and posterior portions of the ribs, the posterior portion being so much denser than the anterior that, even when distant 8 inches from the screen, it throws a shadow as dense as the anterior portion placed in apposition to it. As the heart is nearer the anterior surface of the chest, its shadow is much more distinct and less exaggerated when the screen is on the anterior surface. So, too, the left lateral aortic bulge, being nearer the posterior surface, has a more distinct shadow when the screen is on that surface.

Other normal shadows are produced by the scapulæ,* by the mammæ in some women, and by the anterior axillary fold in muscular subjects. The first mentioned is most marked when the screen is on the posterior surface, and can easily be identified by moving the arms; the last two are only seen with the screen on the anterior surface of the chest. These shadows present no difficulties as a rule, and by the stereoscopic method can be shown to be outside the chest altogether.

There are other appearances which can be observed when the screen is on the anterior surface of the chest. One is a triangular space, which is seen to exist between the shadows of the heart and diaphragm; it lengthens and widens during deep inspiration, and on rare occasions to such an extent as to completely separate the shadows of the heart and diaphragm. It has been described by Halls Dally (50), and called by him the cardio-phrenic space. It is not seen so well on the photographic plate, owing to the blurring caused by the movements of the heart and diaphragm during the exposure necessary to obtain a skiagram.

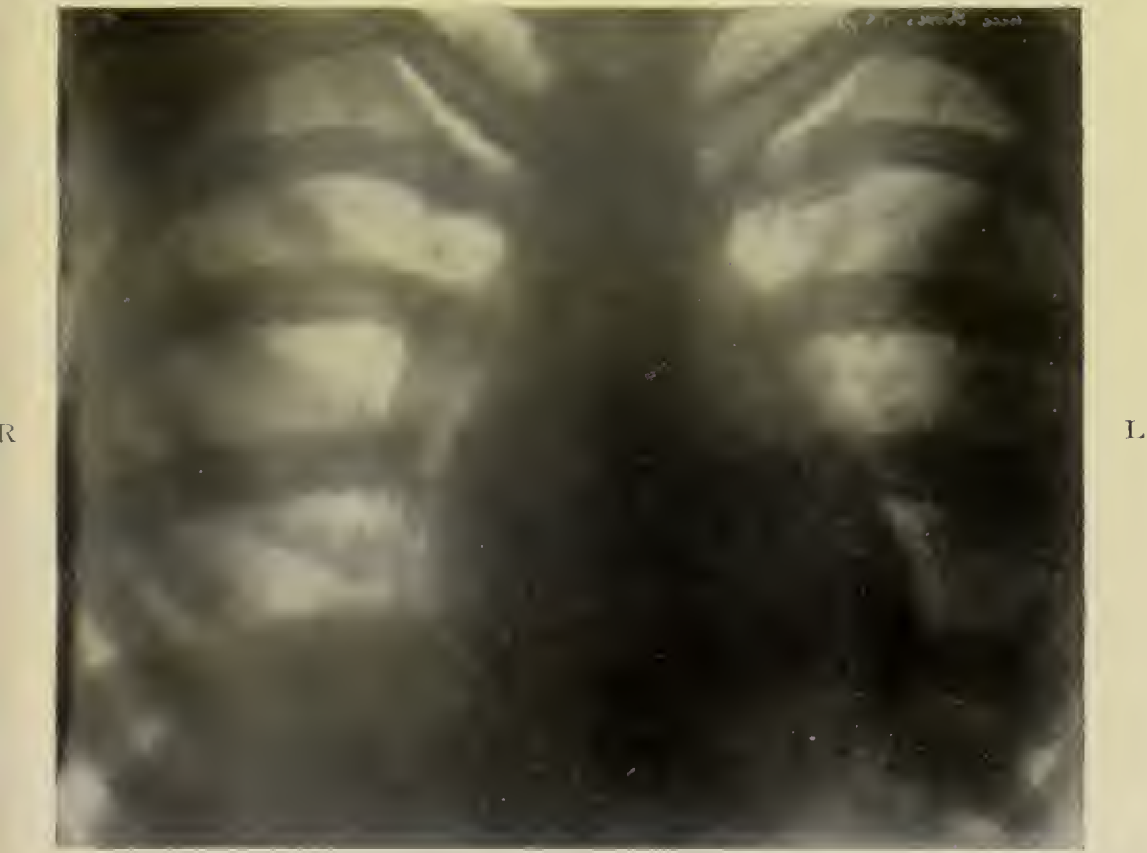
Another appearance which deserves some mention is seen occasionally when the stomach is distended with gas; in this case the shadow of the diaphragm on the left side consists of a mere line which is sometimes difficult to see; and as the stomach area is quite transradiant, the position of the diaphragm may be overlooked, and this appearance may then be confounded with that described in the preceding paragraph if care be not taken.

In addition to these grosser shadows, there are to be seen certain ill-defined shadowy lines on either side of the mediastinal shadow, and following roughly the outlines of the shadow cast by the heart and pericardium (see Plate III.), which, since they are found more or less pronounced in all cases, must be regarded as normal, though their nature is still uncertain. They are invariably more pronounced on the right side than on the left, and it has been suggested that they are caused by the divisions of the lower bronchi. But this is probably not the case, for in the first place their position is too low, and in the second place, if we look at the skiagram of a lung removed from the chest, the larger bronchi show as light areas, and not as

---

* It will be noticed, on examining Plate II., that the shadows of the scapulæ are turned off the chest, which is an advantage in many cases. This can be accomplished by placing the patient in the prone position on the plate, the arms being extended and hanging over the end of the couch.

PLATE III.



NORMAL HEART.

The mediastinal and cardiac lines are well shown. (Plate front of Chest.)

[*To face p.* 20.

shadowy lines. In this connection, we have carried out the following experiment : A skiagram was taken of a dead body on the post-mortem table ; the sternum was then removed, the pericardium opened, and the heart removed ; the sternum and integuments were replaced, and another skiagram taken. The lines still remained ; the chest was then reopened, and the lungs removed ; the sternum and integuments were again replaced, and a third skiagram taken. In this case, with the exception of two distinct lines formed by the junction of the visceral pleura with the pericardium, the majority of them had disappeared, showing to our mind that these lines—in part, at least—depend upon the presence of the lungs ; and we are of opinion at the present time that they may be due to the larger pulmonary vessels. This view has been quite lately strengthened by some interesting observations made by Dr. Hickey, of Michigan (53). In an excellent skiagram of a cadaver published by him, in which the larger pulmonary vessels were injected, there is quite a similarity between the distribution of these vessels and the vague shadows seen in the living subject ; and, further, the fact that these vessels are usually somewhat larger on the right side may also explain the more pronounced appearance of these shadows on that side. We have been at considerable pains to obtain a skiagram of the thorax of a dissecting-room body, but at present have failed to get any result, as the lungs of these bodies become absolutely opaque, owing, no doubt, to the leakage of the lead solution into them.

Professor Cunningham (67) has expressed the view that these lines are caused by the puckering of the outer edge of the pericardium during cardiac systole. But the lines which remain when the lungs are removed are not sufficiently pronounced to account for them. Moreover, they appear to be equally distinct on the screen both during systole and diastole.

But whatever their nature, their recognition as normal shadows is extremely important, lest they be mistaken for some pathological condition of the lungs.

Before concluding the description of the anterior and posterior examinations, it will be well to say a few words more concerning the shadows of the diaphragm, as these are the positions in which observations of the muscle are made. The shadow, as has been stated, presents two dome-shaped convexities, and from our observations on its behaviour in the healthy chest we have come to the following conclusions : that the shadow on the right side lies at a somewhat higher level than that on the left ; that the dome plunges up and down with the movements of respiration, after the manner of a piston ; that the flattening which is said to take place in most works on physiology cannot be observed, the curve of the convexity appearing to remain the same both during ascent and descent ; and that during quiet respiration the average range of movement is from ½ to ¾ inch on both sides, though there is a tendency for the range of movement to be slightly greater on the left side during forced respiration. Any inequality in the excursion on the two sides is pathological. Our observations were made with the screen on the posterior surface of the chest, and the tube in front at the level of the diaphragm. With the screen on the front of the chest, the range of movement was slightly less all round—a fact due, no doubt, to the closer proximity of the upper limit of the curve to the front of the chest. But it must be remembered that measurements will vary in individual cases within normal limits ; thus, the excursion is greater in young adults than in older persons, and in tall persons with a long thorax than in shorter persons with a very deep chest, so that any very exact measurements will be useless, and one must use one's judgment in any given case, just as has to be done in the case of percussion, when individuals of various degrees of muscular development are being examined.

Williams (91), of Boston, gives the average excursion between expiration and full inspiration as :

Right Side.	Left Side.
6·8 centimetres.	7·1 centimetres.

Quiet breathing :

1·7 centimetres.	1·5 centimetres.

Gardiner (35), between expiration and full inspiration :

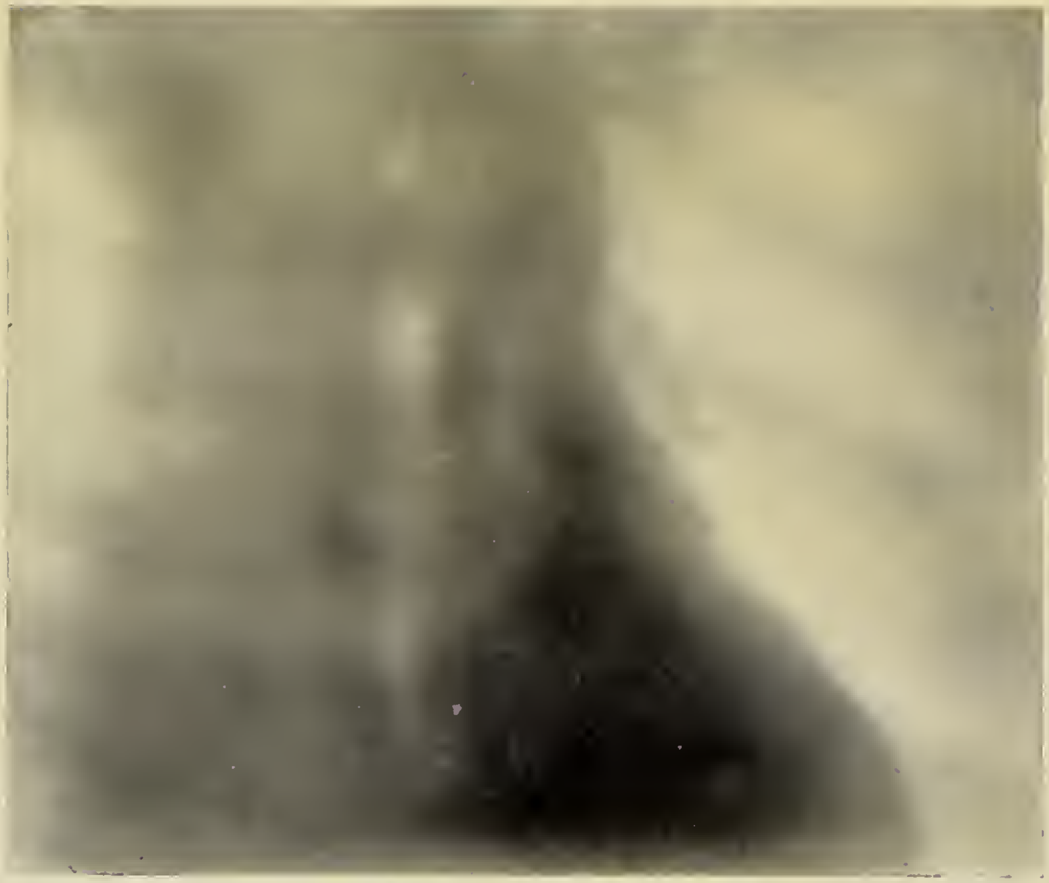
Right Side.	Left Side.
2⅝ inches.	2⅞ inches.

Halls Dally (50) gives the average range of movement as ½ inch on both sides.

More recently Drs. Guilleminot and M. Vannier (48), from orthodiascopic observations, have come to the following conclusions :

OF

PLATE IV.



NORMAL HEART AND AORTA IN RIGHT ANTERIOR OBLIQUE POSITION.
(*See* Fig. 18.)

[*To face p.* 23.

(1) That on the right side the mean position of the diaphragmatic curve is 16·5 centimetres below the suprasternal notch, and on the left side 18·5 centimetres below that line.

(2) The normal amplitude of the diaphragmatic incursion is from 16 to 18 millimetres; it is approximately equal on the two sides.

(3) Any variation in the amount of the incursion on the right and left sides is a pathological symptom.

3. **The Right Anterior Oblique Examination.**—Having thus described the various appearances which can be made out in the anterior and posterior examinations, we will now go on to describe those which are seen in the right anterior oblique position (Plate IV.)—a most important one when studying the thoracic aorta, and introduced by Holzknecht of Vienna.

In this examination the rays are made to penetrate the chest obliquely at an angle of 45 degrees from behind forwards, and from left to right—that is to say, with the tube behind and to the left, and the screen in front and to the right. The radioscopic image seen is more complex than in either the anterior or posterior positions, and presents three clear zones (see Plate IV. and Fig. 18), corresponding to the area of the lungs. These zones are crossed by the curved shadows of the ribs, and are bounded and separated from one another by two distinct vertical shadows, the shadow of the vertebral column to the left, and the shadow of the heart and aorta to the right of the observer. In this position the cardiac shadow is triangular in shape, the base being continuous with the shadow of the diaphragm, while the superior angle is prolonged into a vertical, ribbon-like offshoot, produced by the superimposed shadows of the descending and ascending portions of the aortic arch, which are successively traversed by the same rays. This ribbon-like aortic shadow is equally broad throughout its whole length, with parallel sides, and terminates at the level of the sterno-clavicular articulations and the third dorsal vertebra in a somewhat rounded extremity.

4. **The Left Posterior Oblique Examination.**—In this examination the rays are made to penetrate the chest obliquely as before, but the position of tube and screen is reversed. Its chief use is in examining the œsophagus. The appearances are not unlike those seen in the preceding examination: there is the same clear space

between the shadow of the vertebral column and the cardio-aortic shadow, but this latter is less distinct. It is in this clear space that we are enabled to see opaque substances introduced into the œsophagus which might be masked by the central opacity in the antero-posterior positions.

5. **The Left Lateral Examination.**—In the left lateral examination the tube is placed on the right side, and the screen on the left side of the patient. Its chief use is in determining the antero-posterior diameter of the heart.

In this position the shadow of the heart is seen, bounded by two clear spaces, somewhat triangular in form, the retrosternal space in front, between the anterior and upper portion of the heart and the chest-wall, and the retrocardiac space below; first described by Williams in 1898 (95). The retro-cardiac triangular space is bounded by three more or less curved lines, formed by the posterior border of the heart in front, by the anterior surface of the vertebral column and structures immediately in front of it behind, and by the diaphragm below. It can, as a rule, be well made out on deep inspiration, and in some cases it is seen that the anterior angle is not closed. The retrosternal space is seen to widen and lengthen on full inspiration, the heart moving downwards and the upper part backwards.

Relative Value of Appearances seen on the Fluorescent Screen and Photographic Plate.—There has been a good deal of discussion from time to time as to the relative value of the appearances seen on the screen and photographic plate; but it is evident that radioscopy records dynamic and radiography static conditions, and therefore no evidence as to function can be obtained by this latter method. Every case should first be examined radioscopically, and in the vast majority no further examination will be needed as far as diagnosis is concerned. It has been stated that radiography is of use only for obtaining permanent records of the "grosser lesions"; such a statement we cannot let pass unchallenged. The action of the X rays on a photographic plate is surely a cumulative one, and in the examination of cases of early pulmonary tuberculosis we have over and over again seen fine details brought out on the photographic plate, which had been missed in a very careful screen examination; hence, in these cases, at any rate, very important additional evidence is afforded by radiography.

Radiography also affords a ready means of obtaining permanent records of what has been observed on the fluorescent screen, which will prove very useful when comparing the results of different examinations at distant dates. For accurate comparison, it will be necessary to record the time of exposure, the equivalent spark-gap of the tube, the milliampèrage of the current going through the tube, the distance of the tube from the plate, the position of the tube with regard to the patient, and also the position of the patient.* With these factors as nearly as possible the same, the results obtained at different examinations will give us a fairly accurate record of the differences in the extent of the lesions at different dates. This will apply, of course, chiefly to pulmonary conditions. The methods of recording the measurements of the heart and excursion of the diaphragm by the use of tracings has already been mentioned under orthodiascopy.

---

* It is always best, when practicable, to decide on the position in which to place the photographic plate by a screen examination. The position in which the lesion is best seen having been found on the screen, the plate can then be fixed in this position, and the fact recorded for future reference. It is evident that a small lesion in the anterior part of the lung might be overlooked if a skiagram were taken with the plate on the posterior surface of the chest and *vice versâ*.

CHAPTER III

PULMONARY TUBERCULOSIS

As long ago as October, 1896, Williams, in an article in the *Boston Medical and Surgical Journal*, said : " I have examined about forty cases of pulmonary tuberculosis, and find not only that the fluoroscope is of value in determining the extent of the disease, but also sometimes reveals its location where and when it would otherwise have been unsuspected." In December of the same year Professor Bouchard (17) also gave an account of the X rays as applied to the diagnosis of this disease. The question, therefore, naturally arises, What departure from the normal appearance can be made out on the fluorescent screen and photographic plate to help us to diagnose this condition ? We say " help " advisedly, for it is not contended that a diagnosis can be made in all cases by the X rays alone apart from the history ; but there are several important changes which can be made out, one or more of which will be found more or less pronounced in all cases :

1. The movement of the shadow of the diaphragm is restricted on the affected side or sides, usually in the lower part of its excursion.
2. One or both apices fail to light up on deep inspiration.
3. The diseased portions of the lung cast a dark shadow.
4. The heart in a large majority of cases is smaller than normal, and placed more vertically in the chest.

In more advanced cases displacement of the heart can often be made out better by means of the rays than by percussion.

5. Alteration in the shape of the chest and position of the ribs can in many cases be determined more easily by means of the rays than by any other method at our disposal.

1. **Movements of Diaphragm.**—Of these changes, the restricted movement of the diaphragm is an early and very frequent sign, and may be noted in some cases before any darkening of the lung

becomes evident. That this limitation takes place is admitted by most, if not all, observers; but whether it takes place before other signs are apparent is at present very far from settled. Williams in his book says that this restriction of movement is sometimes one of the earliest signs of pulmonary disease. Bonnet Léon (15) goes even further, and speaks of this "diaphragmatic sign" as occurring at a time which he calls the "pretuberculous" period, stating that children and adults born of phthisical parents nearly always present it. This seems to be putting the matter rather extravagantly, and we must confess we do not understand what can be meant by the "pretuberculous" period. But without going as far as this, we are inclined to agree with those who hold that this sign may be present before any other definite physical signs can be made out, and before any definite shadow can be observed on the fluorescent screen or photographic plate. Nor do we mean to imply that the tuberculous process has not then begun; rather, we regard this sign as pointing to the presence of a lesion at a stage when hitherto we have been unable to recognise it. As an instance of this the following case is of interest: The patient, a man aged twenty-five, was sent for X-ray examination of the chest in December, 1904, with a view to throwing some light on certain obscure cardiac symptoms, which had come on after a long bicycle ride. It was then noticed that the movement of the diaphragm on the right side was very much restricted. There were no symptoms or signs of any lung trouble, and no difference in density between the two apices could be observed on the fluorescent screen. This fact was pointed out to the physician in charge, and the patient was admitted into hospital. During his stay of one month he was examined by several physicians, but it was not until October, 1905, that definite signs were discovered at the right apex. The case has since advanced, and there is now no doubt as to the diagnosis of pulmonary tubercle.

As to the cause of this interesting phenomenon, we cannot at present offer any definite explanation. It has been variously ascribed to:

1. Toxic causes injuring tissue vitality.
2. Loss of elasticity of the lung.
3. Unrecognised pleurisy which has left adhesions.
4. Reflex faulty innervation.

But at the best these are only surmises. It is, however, quite possible to conceive that the tuberculous process may exist in a form capable of damaging the normal elasticity of the part of the lung affected before it reaches a stage in which it is capable of casting a shadow on the fluorescent screen or giving rise to other physical signs; and the prolonged expiration at one or other apex, which in some early cases may be the only sign of disease, seems to lend support to this explanation of the restricted movement, though in some cases, no doubt unrecognised, pleuritic adhesions may account for it.

In some cases a jerky movement of the diaphragm on the affected side or sides may be a more marked feature than limitation of movement. Instead of plunging up and down smoothly, a peculiar hesitating movement is noted which is rather difficult to describe, but quite familiar to anyone who has examined a large number of tuberculous chests. We have noticed it in some cases which present "cog-wheel" respiration at one or other apex.

In other patients the diaphragm may be fixed. We have seen such cases. In one which was examined some months after a severe attack of pleuro-pneumonia, the diaphragm on the left side was absolutely immobile; there was a marked mottled shadow at the left apex. In this case, perhaps, the fixation of the diaphragm could be accounted for by the presence of pleuritic adhesions. But it would appear that absolute immobility can take place in pulmonary tuberculosis in the absence of fluid or adhesions. In this connection, a case published by Dr. David Lawson (65) is of interest. In his patient the diaphragm was immovable, but later, as the lung lesion improved under treatment, this immobility gradually disappeared. This brings us to another point—namely, that in certain advanced cases the movement of the diaphragm on the most affected side may be greater than that of the side less affected, and Dr. Lawson has made some interesting observations on this point. He examined a series of patients when active disease was present, and again later, when they had undergone a course of hill-climbing and arrest had been secured. In such cases he states (65): "It has frequently been observed that the diaphragm upon the affected side during the stage of active disease moved less freely than on the sound side, but that as convalescence proceeded and compensatory breathing became established the diaphragm gradually altered the character of its movements, until at length the side which exhibited impaired movement came to show movement which equalled or even surpassed that of the other side, the limitation of movement thus corresponding to the period of activity of the disease." We have not been able to confirm this statement at present, nor can we find any further records on the subject, but if correct, it is another point of extreme importance to be remembered when considering the evidence afforded by the study of the diaphragmatic movements, for it may help us to determine whether a lesion is active or not.

In some cases of localized lung-lesion it can be observed that the amplitude of movement of the diaphragm varies with the situation of the disease. Thus, in cases in which consolidation is most marked in the posterior part of the lung, the range of movement of the diaphragm is found to be more restricted behind than it is in front; and, further, the shadow of the diaphragm is at a higher level behind when the lesion is posterior, and in front when it is in the anterior portion of the lung. This phenomenon was first pointed out in March, 1904, by Dr. David Lawson (65) under the heading of "Associated Movements," and has since been confirmed by Dr. Stanley Green (38) and ourselves.

The study of the movements of the diaphragm should be made first during quiet inspiration, and the level to which this muscle rises and falls on both sides marked on a piece of ground glass placed in front of the screen. The level to which it descends on deep inspiration should next be marked, and finally the level to which it rises on forced expiration. The measurements should be made with the screen both on the anterior and posterior surface of the chest, and any difference in the range of movement of the anterior and posterior portion on the same side noted.

Finally, in all doubtful cases at least two examinations should be made at different dates, as many mistakes will be made if an opinion is given as a result of one examination only.

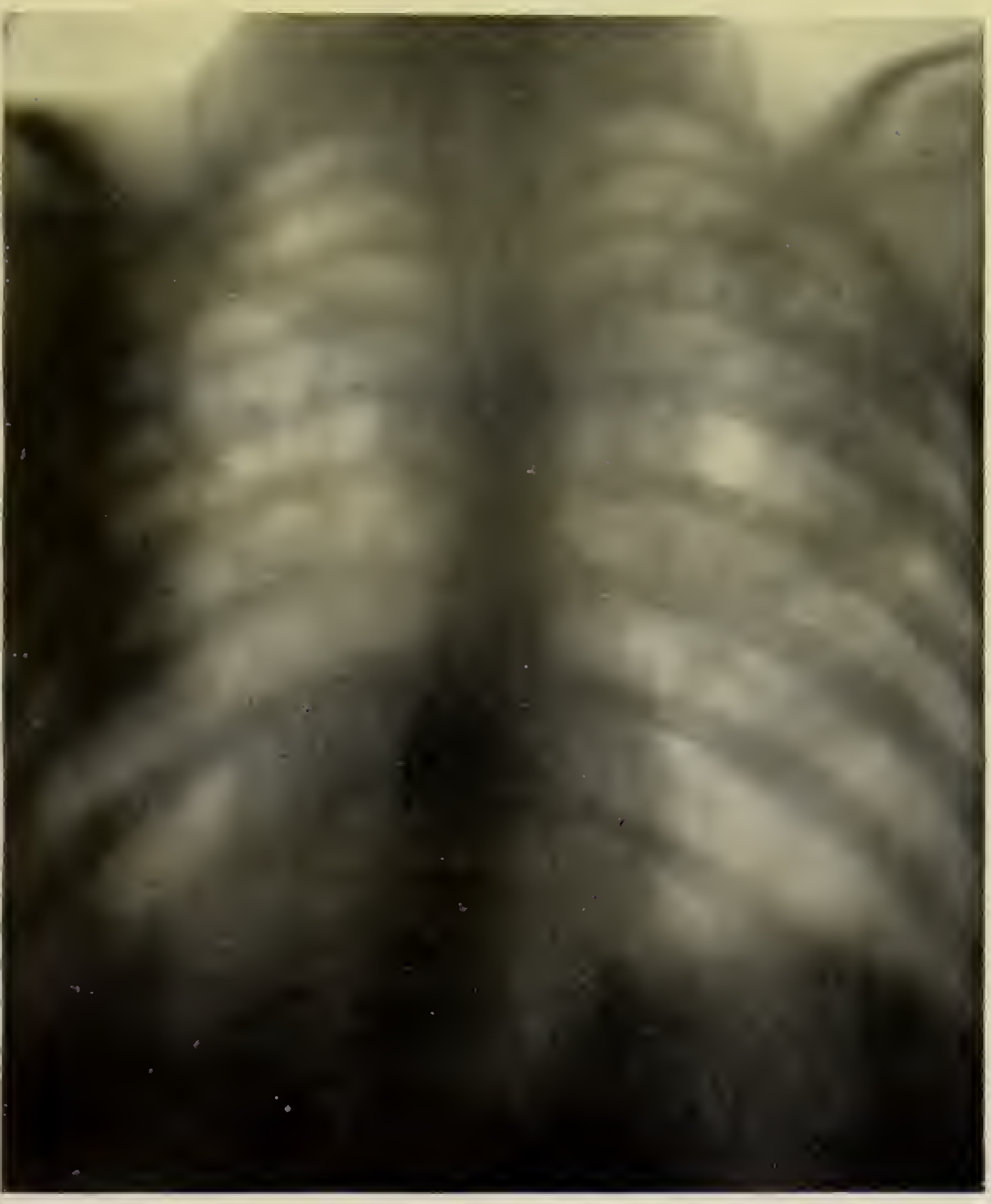
2. **Translucency of the Apices of the Lungs.**—As has been stated, the pulmonary image in health is clear from apex to base (see Plate II.). If a normal chest be examined with the fluorescent screen, it will be seen that there is a marked difference in the fluorescence on the screen in deep inspiration and expiration respectively. On deep inspiration the fluorescence of the screen corresponding to the pulmonary areas is greatly increased, due,

no doubt, to the fact that the greater amount of contained air in the lungs during this act renders them more permeable to the rays than on expiration, though Williams (91) considers that it is due to the smaller amount of contained blood. The failure to brighten up of one or other or both apices on deep inspiration is one of the earliest signs of pulmonary tuberculosis, and can certainly be made out before any distinct mottled shadowing, to be described later, becomes evident. In making a comparison between the two apices, care must be taken to adjust the light so that the suspected side is barely illuminated; the contrast between it and the normal side will then be more obvious. If the quantity of rays employed or their penetrative power be too great, small differences in density will not be apparent, and the condition entirely overlooked. In difficult cases the use of the lead diaphragm between the tube and patient is extremely useful. The luminous sensibility of the observer must of course be as great as possible (see p. 17).

If we now examine a radiogram of a case of undoubted pulmonary tuberculosis (Plate V.), the contrast to the appearances seen in health is at once apparent, for in place of the clear image of the pulmonary area we see the marked mottled shadowing which is so characteristic of the disease, dark patches alternating with the light unaffected areas. The amount of this shadowing corresponds with the extent of the disease, and may be present in all degrees, from the slight shading of one or other or both apices (Plate VI.) to the marked mottled shadowing of both lungs just mentioned.

3. **Causes of the Shadows.**—We have demonstrated that these shadows are cast by the diseased portion of the lung in the following manner. Plate VII. is a skiagram of a tuberculous lung in which nearly the whole of the upper lobe is caseous and breaking down, and the lower lobes filled with gray and yellow tubercles. This skiagram shows that the caseous material casts a very dense shadow, and that a definite but not so dense a shadow is cast by the gray and yellow tubercles lower down. It has been asserted that these mottled shadows are caused by congestion around the tuberculous foci, on the assumption that, next to bone, the blood is more opaque than any of the soft tissues. With this assertion we cannot agree, as the shadows remain the same after the lung has been freed from blood. This we have demonstrated as follows: A skiagram of the lungs

PLATE V.

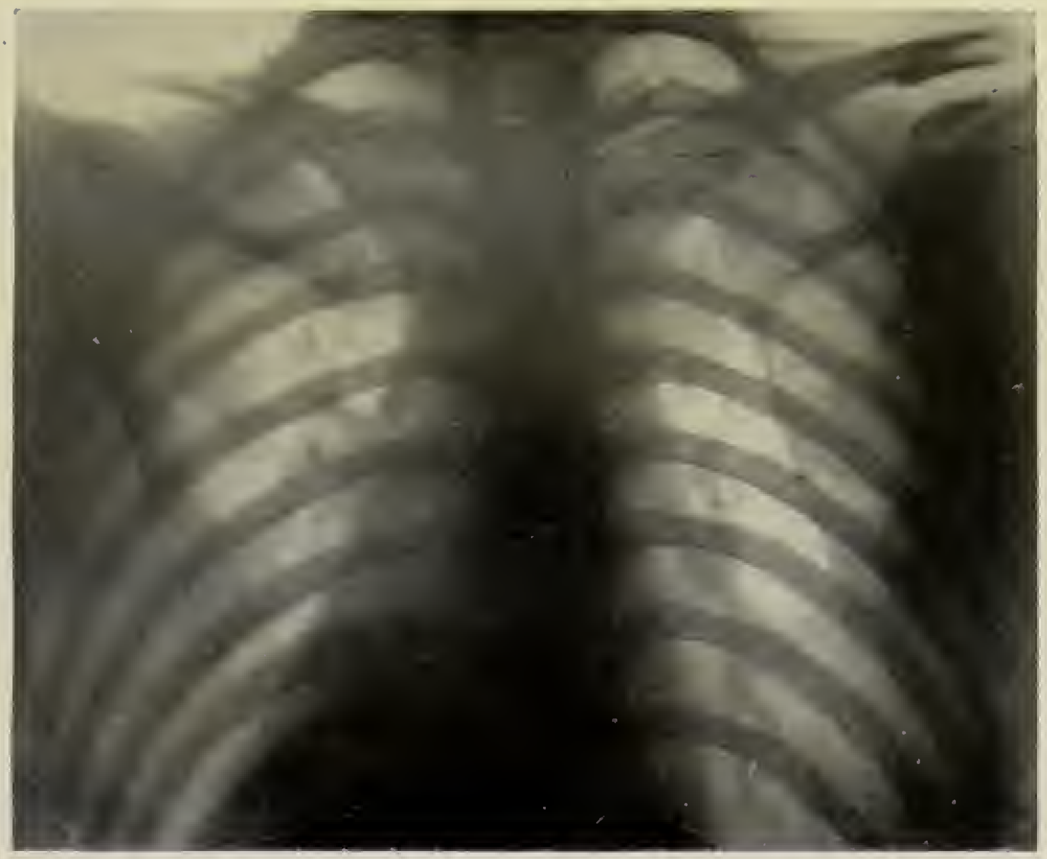


EXTENSIVE PULMONARY TUBERCULOSIS.

Note cavity (light area) with surrounding infiltration. (Plate back of Chest.)

[*To face p.* 30.

PLATE VI.

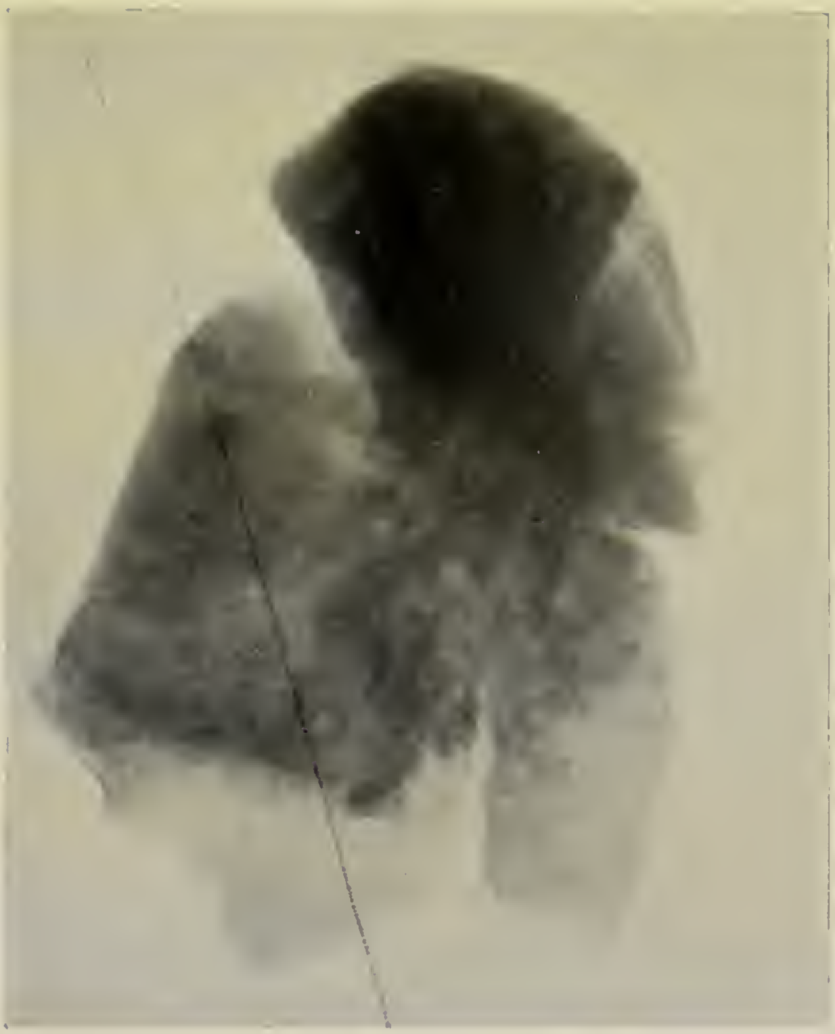


Early Pulmonary Tuberculosis.

(Plate back of Chest.)

[*To face p.* 30.

PLATE VII.



Tuberculous Lung taken Post-mortem.

Note very dense shadow cast by caseous portion at apex, and definite but not so dense shadow cast by the gray and yellow tubercles lower down.

[*To face p.* 30.

from a case of tuberculosis was taken. The lungs were next soaked in water for some hours to break up the blood corpuscles, and the vessels washed out until the water came away colourless. Another skiagram was then taken, and the shadows of the diseased portions of the lungs remained the same.

Having shown that the diseased areas are capable of casting a definite shadow, the next question naturally arises, At what stage of development is a tuberculous lesion capable of casting a shadow ?—a question not easy to answer. There are some who hold that no shadow is cast until caseation or calcification has taken place, but we think Plate VII. shows that it is apparent before this stage, for the gray tubercles cast a definite shadow. Moreover, we have been fortunate enough to obtain a skiagram of the chest of a child suffering from miliary tuberculosis in which the miliary tubercles can be distinctly seen. The child died a few days after the X-ray examination, and post-mortem it was found that the tubercles had not advanced to caseation. This case is of further interest in that the diagnosis rested upon the X-ray examination, as previous to this the case was regarded as one of enteric fever.

Colonies of tubercle bacilli on agar-agar glycerine cast no shadow when the agar is removed from the glass vessel and a skiagram taken, but it is probable that as soon as there is a cellular element sufficient to form what we recognise as a definite tubercle the lesion is capable of casting a shadow. Now, although we must confess we are not able at present to detect with certainty by means of the Röntgen rays the very earliest stages of the disease, yet we are convinced by our own experience that in many cases a distinct mottled shadowing (and it has been mentioned that this is not the earliest sign given by the rays) can be detected before any definite physical signs can be made out. In support of this statement we would instance the large number of cases in which, although physical signs are evident at one apex only, the X-ray examination shows both sides to be affected, and also the cases in which, with only slight signs at one apex, the rays reveal shadowing of almost the whole lung. Such cases we have observed over and over again, and think it is the experience of almost all workers in this special subject (see illustrative cases at end of chapter).

Again, in cases of emphysema, where the lungs are more transradiant than normal, the presence of coexistent tubercle is the more easily detected by the rays than usual, whereas by the ordinary physical signs its detection may be impossible.

Plate VIII. is from a case of emphysema in which no signs of tuberculosis could be discovered by percussion or auscultation, and demonstrates well the extensive changes which may be overlooked if an X-ray examination be neglected. Some of the shadows in this skiagram are so dense that it is probable they represent calcified areas.

Dr. Theodore Williams, in the discussion at the International Congress on Tuberculosis held in Paris in 1905, divided his cases into the three following classes :

1. Where early tuberculosis is indicated by the rays before its detection by auscultation and percussion ;

2. Where its presence was localized simultaneously by Röntgen rays and physical signs (and this was far the most numerous class) ;

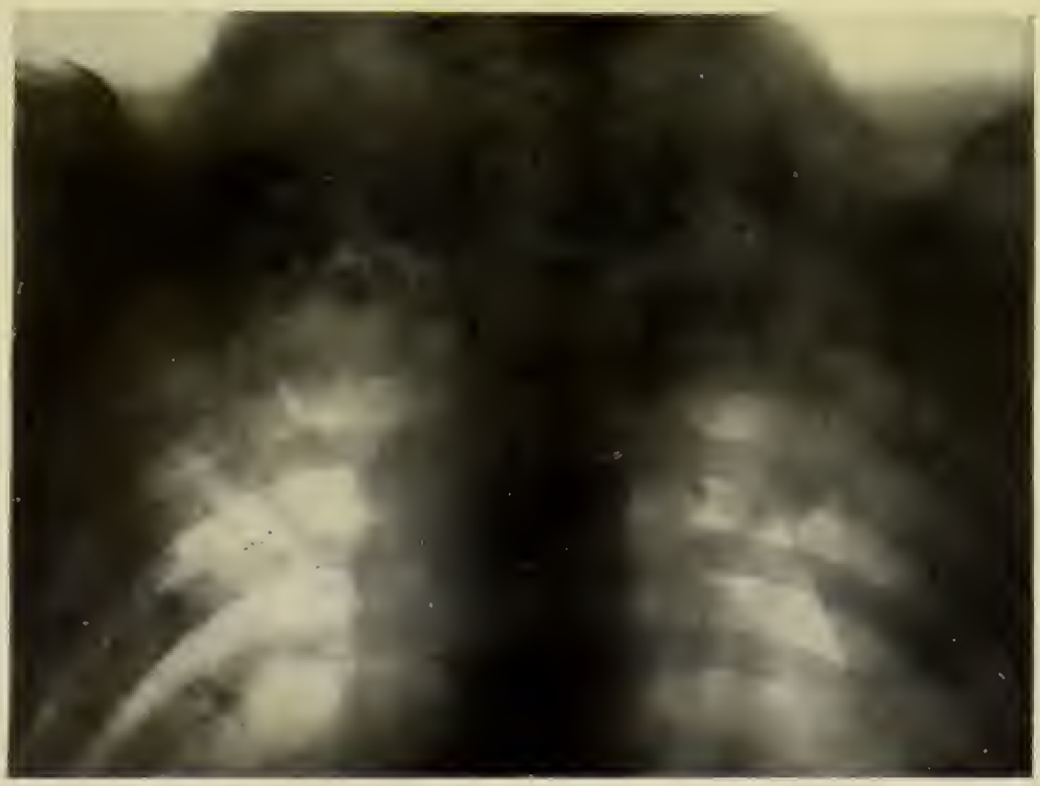
3. Where the physical signs detected lesions which were undetected by the Röntgen rays. (This class was quite as numerous as Class 1.)

With regard to Class 1, the existence of such cases cannot be doubted, and we have seen cases with quite extensive mottling on both sides, in which, by the ordinary physical signs, the disease had been entirely unrecognised (see Plate XVIII.).

With regard to Class 2, there is no doubt that a large majority of the cases fall into it, for at present suspected cases without physical signs are not, as a rule, submitted to X-ray examination. Under this heading, however, no mention is made of those cases just touched upon, in which the Röntgen rays demonstrate the presence of disease in both lungs when by auscultation and percussion it has been pronounced to be in one only. Our observations on the point have been confirmed by Dr. Stanley Green (37), who in a recent letter to the *British Medical Journal* goes as far as to state : " I am firmly convinced that if all cases of pulmonary tuberculosis were examined by an expert radiographer, when, as a result of physical examination, the physician had pronounced them to be unilateral, the Röntgen rays would prove that in a majority the disease was present in both lungs."

With the statement that Class 3 is as numerous as Class 1 we cannot agree, and, in fact, are inclined to question whether it can be said that there is such a class at all, for we have not yet

PLATE VIII.



EXTENSIVE TUBERCULOUS INFILTRATION OF BOTH LUNGS, PROBABLY CALCIFIED IN PARTS.

Physical signs on auscultation and percussion masked by those of emphysema.
(Plate back of Chest.)

[*To face p.* 32.

seen a case which could be proved to be one of pulmonary tuberculosis in which its presence could not be demonstrated after a careful examination. Out of the number of cases examined for the purpose of verifying these statements we found only one which gave physical signs but was negative to X-ray examination. This has since proved not to be one of pulmonary tuberculosis (Case 1).

We will not go so far at present, however, to say that such cases may not exist. Williams of Boston (91), in the year 1901, mentioned two cases of undoubted pulmonary tuberculosis in which he was unable to detect the lesion by the rays. He suggests that this failure may have been due to defective technique, which no doubt since that time has improved considerably. In this connection it is important to bear in mind those cases in which physical signs undistinguishable from those of tuberculosis may be present, such as cases of mitral stenosis, in which there are impairment of note, prolonged and harsh expiration, and dry crepitations due to pulmonary infarction, and, again, those in which physical signs are found after whooping-cough, especially in young children, which, apart from the history, could not be differentiated from those of pulmonary tuberculosis. Yet they clear up, and leave the lungs perfectly healthy.

Williams of Boston (91) in his book states : " In some cases seen by me the symptoms and physical signs indicated tuberculosis, but the X-ray examination showed normal lungs. These examinations led me to state that these patients were probably not suffering from this disease ; and the subsequent history or the tuberculin test indicated that this interpretation of the appearances seen on the fluorescent screen was correct."

Here it will be well to mention again the importance of radiography as an aid to radioscopy in these cases. We are convinced that fine details are brought out and the extent of the shadowing often more accurately determined on a good skiagram than on the fluorescent screen.

Before going further, too, it will be perhaps well to point out again that it is not contended that a diagnosis can be made in all cases by the X rays alone ; thus, the shaded apex and the shortened excursion of the diaphragm might be due to a recent pneumonia, and the history will be necessary. Such a case again emphasizes the fact that in doubtful cases an opinion should not be given on one examination, but that at least two examinations should be made at some weeks' interval, to avoid such errors; also, by such a procedure evidence as to the activity of the disease may be obtained by noting the difference in the extent of the mottling at different examinations.

4. **Size and Position of the Heart in Pulmonary Tuberculosis.**—The borders of the heart, as is well known, can, as a rule, be easily made out by an X-ray examination, and its size more accurately determined by orthodiascopy than by percussion. This point will be discussed more fully when dealing with the cardio-vascular system.

We have frequently noticed that in a large majority of cases of pulmonary tuberculosis the heart is seen to be much smaller than normal, and placed more vertically in the chest. In some cases the extreme smallness of this organ is very striking.

Professor Bouchard and Dr. Balthazard, of Paris, have made a special study of the size of the heart in tuberculous subjects (22 and 24), and in their communication to the International Congress on Tuberculosis, held in Paris in 1905, stated that they had come to the following conclusions:

That in the first stage of pulmonary tuberculosis the heart is, as a rule, smaller than normal, and the same condition holds in the second stage. They infer that the small size of the heart is characteristic of a tuberculous soil—that is to say, one of the dystrophies which predispose to tuberculosis. In the third stage, on the contrary, the heart is larger than normal, hypertrophy developing without dilatation. This is probably brought about by the increased resistance in the pulmonary circulation caused by the development of caseous and fibrous lesions in the lungs.

These observations explain the apparent contradictions which have existed in the observations of other authors, the dimensions of the heart in tuberculosis having been studied mainly in the post-mortem room rather than during life.

In some cases, however, the heart in the first and second stages is normal in size. The above authors consider that such patients have succumbed because they have been exposed to exceptional contagion, and it is possible, as Guilleminot (48) points out, that cases which are cured are those which, in the first stages of the disease, possess a heart whose size is above that of the normal. Observations on this point are at present too few to enable us to draw any definite conclusions, but the question is one which ought to be remembered when considering the prognosis of any given case.

In more advanced cases displacement of the heart due to retraction of the lung can often be much more accurately determined by the rays than by percussion. This is more especially the case when the displacement is to the right. The dulness of the pulmonary area in such cases may be sufficient to make it impossible to distinguish between it and the cardiac area on percussion, although the shadow cast is not dense enough to mask the cardiac outline on radioscopic examination. Sometimes, however, the shading is so dense as to completely obscure the heart borders. In such cases, of course, the rays offer no advantage over percussion. Cases in which both borders are obscured, however, are very rare.

5. **Alteration in the Shape of Chest and Position of the Ribs.**—These points are not so important, for when the disease has reached so advanced a stage there is usually very little doubt as to the diagnosis ; but a more accurate idea of the bony alteration can be obtained by X-ray examination, and differences in the amount of movement of the ribs on the two sides is much more apparent. In many cases the amount of deformity revealed by the rays in cases where little if any is suspected is very remarkable. A peculiar slope of the ribs, giving a "roof-tile" appearance, is often seen associated with chronic lung disease. It is probable, as has been pointed out by Drs. Lawson and Hill Crombie (67), that this condition, owing to the narrowing of the intercostal spaces associated with it, may account for the difficulty sometimes experienced in an effort to procure a percussion note in the intercostal spaces of one side as compared with that of the other.

Cavities in the lung can, as a rule, be well made out on radioscopic examination and their size accurately determined. The appearances presented will vary with the position of the cavity and the nature of its contents. When filled with air they appear as light areas, and when filled with pus or retained secretions as dark areas. There is often a good deal of consolidation surrounding cavities (see Plate V.). This, no doubt, accounts for the fact so often observed that the signs on auscultation and percussion are at variance with the appearances revealed on radioscopic examination. If the consolidation around a small cavity be very great and the cavity filled with pus or retained secretion, its presence may be masked, but in most cases it is beautifully shown, and there is no doubt we can diagnose a cavity much smaller than can be detected by auscultation. In fact, we are inclined to maintain that a radioscopic examination is the only way in which its presence can be demonstrated with certainty. The fallacies of auscultation and percussion are too well known to need discussion here.

Fibrosis of Lung.—The fibrous portion casts a dense shadow, and there may be a certain amount of mottling, though in very advanced cases the affected side appears uniformly dark in marked contrast to the non-affected side (see Plate IX.). The diagnosis between this condition, pleural effusion, and thickened pleura will be considered in the next chapter.

Calcification.—Areas of calcification cast a much denser shadow than even caseous material. Plate I. is a case of calcified miliary tubercle taken stereoscopically (see also Plate VIII.).

Enlarged Bronchial Glands.—These can, as a rule, be made out. In some cases there is a marked broadening out of the mediastinal shadow, in some instances resembling the shadow cast by an aneurysm of the aortic arch (Plate X.). In other cases, especially if caseation or calcification has taken place, individual glands can be made out. The left lateral and right lateral oblique examinations should never be omitted, as we have frequently been enabled to detect enlarged glands which were entirely masked by the central opacity in the ordinary anterior or posterior examination, and which would certainly have been overlooked had this procedure been omitted.

Plate X. is of further interest, as the tuberculous infiltration which is so marked at both apices gave rise to no physical signs, and its presence was not suspected until after the X-ray examination.

Illustrative Cases.

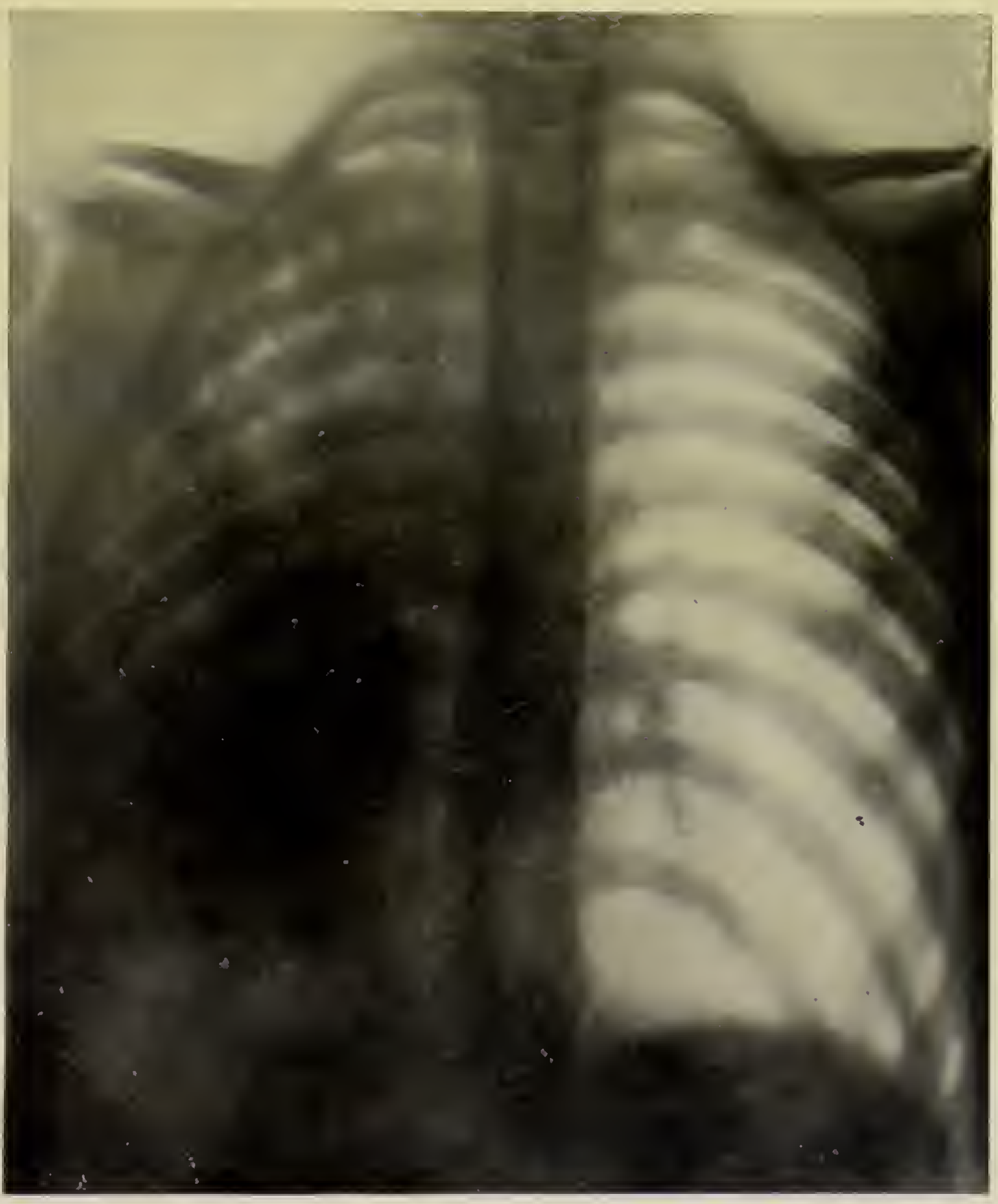
CASE I.—M. G., female, aged fifteen, box-maker. Cough for six months, with expectoration; hæmoptysis three months; night sweats; loss of weight; dyspnœa on exertion; pain in left infra-axillary area.

Physical Examination.—Occasional râle at right apex.

X-ray Examination.—Both lungs quite clear from apex to base; no signs of mottling on photographic plate.

Diaphragmatic movement: Average, and equal on both sides.

PLATE IX.

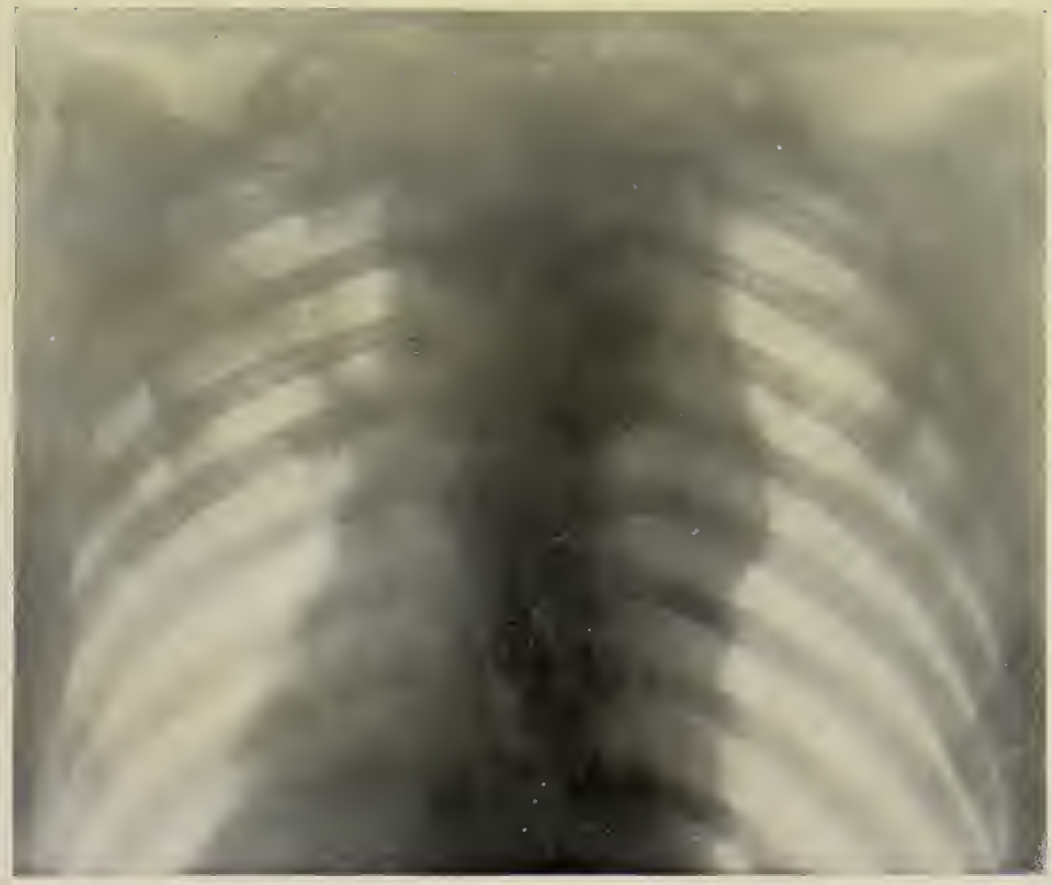


FIBROSIS OF LEFT LUNG.

Right border of heart not seen, being drawn over to the affected side.
(Plate back of Chest.)

[*To face p.* 36.

PLATE X.



Enlarged Bronchial Glands.

Note tuberculous infiltration at both apices, not diagnosed until an X-ray examination had been made (*cf.* Plate XVII.). (Plate back of Chest.)

[*To face p.* 36.

NOTE.—Admitted as pulmonary tuberculosis, but X-ray examination was negative.

Hæmoptysis and cough have all cleared up, since slight operation on throat. Patient has been under observation for one year, and remains quite well. Expectoration showed no tubercle bacilli on three examinations.

CASE 2.—Female, aged twenty-four, dressmaker. Complained of general weakness, anæmia, loss of weight. No cough; no hæmoptysis; no night sweats.

Physical Examination.—Nothing abnormal to be made out.

X-ray Examination.—Faint shadow left apex down to third rib.

Diaphragmatic Movement:

	Right Side.	Left Side.
Quiet respiration	$\frac{5}{8}$ inch.	$\frac{1}{2}$ inch.
Forced respiration	$2\frac{3}{4}$ inches.	$2\frac{1}{8}$ inches.

NOTE.—Case since advanced, and X-ray diagnosis of pulmonary tuberculosis confirmed.

CASE 3.—Male, aged twenty-six, glass-worker. Hæmoptysis two years ago. No cough; no expectoration; no night sweats; loss of appetite and weight.

Physical Examination.—Impaired note right apex in front; dulness over right side as far as fifth rib behind; clear vesicular breathing all over chest; no added sounds.

X-ray Examination.—Shadow right side down to sixth rib, and left side to fourth rib.

Diaphragmatic Movement:

	Right Side.	Left Side.
Quiet respiration	$\frac{1}{2}$ inch.	$\frac{5}{8}$ inch.
Forced respiration	2 inches.	$2\frac{5}{8}$ inches.

NOTE.—Case diagnosed as unilateral; shown to be bilateral on X-ray examination.

CASE 4.—Female, aged thirty-three, domestic servant. Cough for seven months; profuse expectoration; slight hæmoptysis on day of examination; no wasting; no night sweats.

Physical Examination.—Dulness and bronchial breathing right front from clavicle to third rib.

X-ray Examination.—Right side in shadow down to fifth rib; left side in shadow down to third rib.

Diaphragmatic Movement :

	Right Side.	Left Side.
Quiet respiration	$\frac{1}{2}$ inch.	$\frac{1}{2}$ inch.
Forced respiration	$2\frac{1}{8}$ inches.	$2\frac{1}{2}$ inches.

NOTE.—Physical signs unilateral. On X-ray examination shown to be bilateral.

CASE 5.—Male, aged thirty, machinist. Slight cough ; thick expectoration ; night sweats ; wasting ; and no hæmoptysis.

Physical Examination.—Prolonged expiration right scapular region. No other signs could be made out.

X-ray Examination.—Right side, dense shadow to fourth rib ; left side, light shadow to fourth rib.

Diaphragmatic Movement :

	Right Side.	Left Side.
Quiet respiration	$\frac{5}{8}$ inch.	$\frac{3}{4}$ inch.
Forced respiration	$2\frac{3}{4}$ inches.	3 inches.

NOTE.—Physical signs unilateral. On X-ray examination shown to be bilateral.

CHAPTER IV

PLEURISY WITH EFFUSION

In the diagnosis of fluid within the pleural cavity very valuable information can be obtained by an X-ray examination, and in these cases the screen examination is undoubtedly the most important.

The patient should be examined, first either standing or sitting, with the screen placed successively on the anterior and posterior surfaces of the chest; secondly, the same examination should be made with the patient lying on a canvas stretcher, with the tube below, when any alteration in the position of the shadow is to be noted; and, thirdly, if necessary a lateral examination may be made also.

The appearances seen will vary considerably in individual cases, according to the amount of fluid present, the composition of the fluid, the presence or absence of air or accompanying lung lesion, and other factors.

To take first the character of the shadow. This is seen to be homogeneous—that is to say, it shows no mottling as in the case of tuberculous consolidation of the lung. The outline of the diaphragm on the affected side is obscured, as are also the shadows of some of the lower ribs. The extent of this masking will depend, firstly, on the amount of fluid present, and, secondly, on the composition of the fluid, the shadow of a purulent effusion being denser than that cast by a serous one of equal amount. But this contrast will not be evident if a tube of very high vacuum be used, as the rays from such a tube have such a high penetrative power that slight differences of density are overlooked.

The upper level of the shadow varies considerably when air is present, as is the case in pyopneumothorax. It will be seen (Plate XI.) that the upper margin of the shadow is very sharply defined and absolutely horizontal, and no matter at what angle the patient be tilted, it still remains horizontal (Plate XI.). If, however, the patient be laid flat on the back, then the whole of the affected side becomes dark, as in this position the fluid flows over the whole of the posterior wall of the affected side.

Other appearances seen in pyopneumothorax are as follows : On close inspection rhythmical wavy movements corresponding to the heart's action can often be made out. These are more evident if the effusion be left-sided. Similarly, on shaking the patient, the splashing on the surface of the fluid can be beautifully seen. Moreover, the level of the fluid can be seen to rise considerably on deep inspiration ; this is probably due to the pushing over of the mediastinum to the affected side by the expansion of the lung on the sound side. It has been stated, also, that the fluid rises with each systole of the heart when the breath is held ; this we have not observed. These appearances have been not inaptly likened to a tumbler half filled with ink. The portion of the chest above the level of the fluid is unusually clear, the ribs standing out in bold relief. The collapsed lung occupies quite a small area towards the middle line, and the heart and mediastinum are displaced to the opposite side. This condition forms one of the most striking pictures which can be observed on the fluorescent screen, and the diagnosis can never be doubtful.

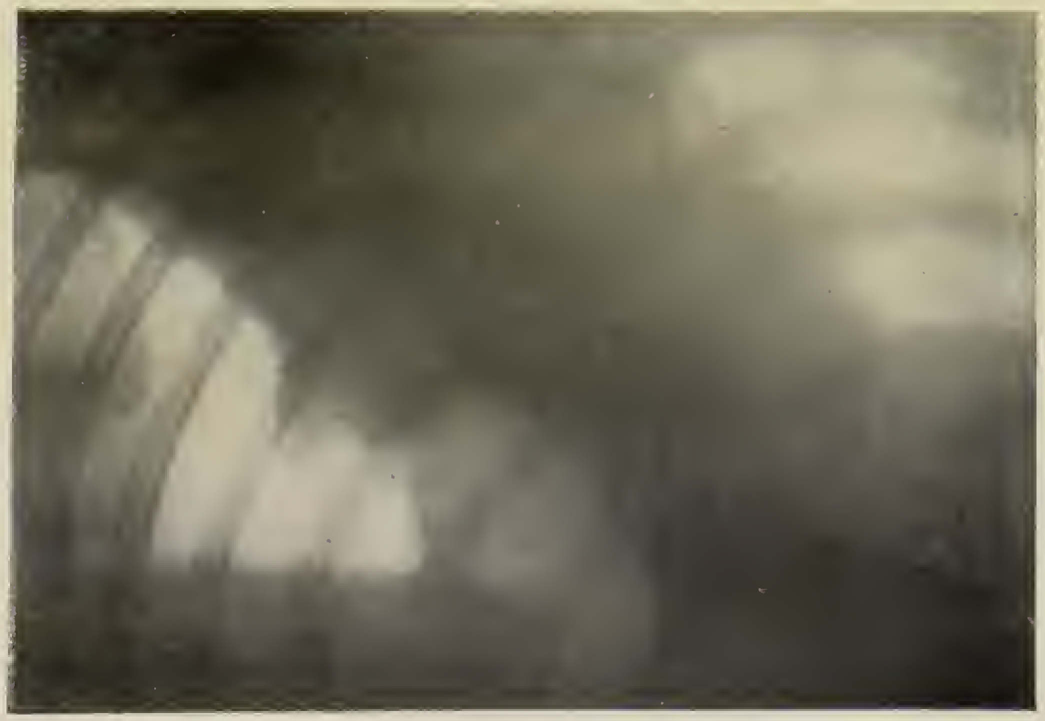
In several cases we have been able to demonstrate this condition by X-ray examination, where its presence was not suspected after the ordinary physical examination had been made, and in two cases where the physical signs pointed to the presence of a large cavity.

In the case of ordinary serous effusion, or empyema, the appearances seen are not so striking. The upper margin of the shadow is vague and indefinite, there being no sharp line of demarcation, and in some cases where the lung above the level of the fluid is compressed, or is the seat of consolidation, it may be next to impossible to make out the upper limit, the whole of the affected side being in shadow. The intensity of the shadow diminishes from below upwards, and the upper limit is not horizontal, but curved, being, as a rule, at a higher level at the inner and outer extremities than in the centre, and the outer extremity is at a higher level than the inner, so that the upper margin is concave; but this is not invariably so. In a paper published by MM. Bergonie and Carrière (14) eleven cases are

PLATE XI.

Pyopneumothorax.

Showing collapsed lung, light area occupied by air, and sharp horizontal line of demarcation between air and fluid. (Plate back of Chest.)



Pyopneumothorax.

Same case, showing that level of fluid remains horizontal when patient is tilted. (Plate back of Chest.)

[To face p. 40.

quoted, in five of which this concave upper margin was marked, in two indefinite, and in three convex above. The latter appearance we have not ourselves observed.

From our own observations it would appear that the greater the amount of effusion present the more nearly horizontal the upper margin becomes, and the less marked the curves just described. This applies chiefly to effusions which are moderate in amount.

The explanation of the fact that the level of the fluid is not absolutely horizontal is not difficult, and it will not be out of place perhaps to mention a simple experiment made by Dr. Lawson (66) in this connection.

Two ice-bags were taken, and into each was poured an equal quantity of serous fluid. From one of the bags air was as far as possible extracted; in the other it was allowed to remain. The bags were then examined with the screen, and it was seen that the following differences existed. In the case of the bag from which air had been extracted a dark shadow was seen, the upper border of which gradually merged into the clear area above. The upper border was also irregularly curved, the edges being drawn up to a considerable distance above the central portion of the curve.

In the case of the bag containing fluid and air there was a sharp line of demarcation between the shadow and the clear area above; further, the line of demarcation was absolutely horizontal, there being no drawing up of the edges.

It is evident, then, that in the case of Bag 1 the force of capillarity has full play, and tends to draw the fluid up, thus accounting for the curve at the edges and for the gradual diminution in the intensity of the shadow from below upwards. Thus, in the case of an ordinary pleural effusion the edges of the fluid are drawn up by capillary attraction, whereas in the case of pyopneumothorax this condition is absent, and the surface of the fluid remains horizontal. For the same reason the alteration in the level of the fluid in different positions of the patient, although it can be made out in most cases, is nothing like so well marked as in the case of pyopneumothorax.

The condition of the lung above the level of the fluid varies. In some cases it is comparatively clear; in others it appears as dense as the fluid, so that no line of demarcation between fluid and lung can be made out. This latter condition is only present when the lung above the level of the fluid is the seat of consolidation, as in pulmonary tuberculosis, and as a rule the pulmonary area above the fluid, even when a very large effusion is present, remains clear (Plate XII.). It has even been said that it is clearer than the pulmonary area on the sound side. With the statement, however, we cannot agree. Nevertheless, it is quite as clear as on the sound side in the majority of cases, which seems to us to point to the fact that collapse of the lung above the level of the fluid does not take place to such an extent as it is generally supposed to do.

The amount of displacement of the heart must be carefully studied. This can often be more accurately determined by an X-ray examination, especially when the displacement is to the right, and will give us very valuable information. In the diagnosis between effusion and solid lung, it will also help us to form some opinion as to the amount of fluid present. This displacement is best studied with the screen on the anterior surface of the chest, the tube being behind.

Let us now consider the chief points which will enable us to draw conclusions as to whether a given shadow is due to pulmonary or pleural conditions.

1. Cardiac displacement due to fluid is towards the opposite side of the chest to that on which the fluid exists; whereas in the case of pulmonary lesions it will, as a rule, be towards the affected side (see Plate IX., where right border cannot be seen at all).

2. In the case of fluid, especially if air be present also as is the case in pyopneumothorax, the level of the fluid alters with the position of the patient, and wavy movements due to the heart's action can often be made out on the surface.

3. Between the outer end of the diaphragm and the chest wall there is a clear, somewhat triangular space which is not occupied by lung except on deep inspiration; even in extensive consolidation of the base of the lung this space can still be seen, whereas a very small amount of fluid will flow into and obliterate it. Therefore, as Williams of Boston pointed out some four years ago, if the diaphragmatic line on a given side can be followed, and the triangular space is shown to be clear, there is no fluid on this side, unless it be encysted higher up in the chest.

4. If there be any changes in the position of the ribs, then in

PLATE XII.

Large Pleural Effusion.

Showing concave upper margin of the shadow of the fluid. Note sharp line of demarcation between shadow of fluid and light pulmonary area. (Plate front of Chest.)

[*To face p.* 42.

the case of fluid the tendency is towards an increase in the intercostal spaces, whereas in the case of lung disease the tendency is towards a decrease—*i.e.*, roof-tile appearance.

5. If the tube be accurately centred, and a line be drawn from the centre of the chest to the outer boundary, then in the case of chronic lung disease the breadth of the chest on the affected side is less than that of the sound side, whereas in the case of fluid it will be, as a rule, either the same or greater than on the affected side.

6. Finally, in some cases the character and distribution of the shadow may be distinctive.

These, then, will be the chief points which will enable us to differentiate between the two conditions, the cardiac displacement, alteration of level of the shadow, and obliteration of the clear space between the outer end of the diaphragm and the chest wall being the most important ones, for it must be remembered that the side containing fluid is not always the larger : it may be contracted. This is especially the case in children. Also, the spaces between the ribs may be decreased. A skiagram of such a case was shown by Dr. David Lawson (66) at a recent meeting of the Medico-Chirurgical Society.

It must also be remembered that in young children from four to eight years of age the heart is placed more to the left than in the adult, owing to the higher position of the diaphragm in children of that age.

In the diagnosis between fluid above and below the diaphragm very great assistance may sometimes be given. In several cases we have seen, in which this point was in doubt, the diagnosis has been settled by an X-ray examination, the upper border being clearly limited by the convex shadow of the diaphragm. In some few cases, however, even with the help of the rays, it is difficult to come to a definite conclusion. In these cases a plan has been devised by Dr. Achard (1), which is as follows : After an exploratory puncture and withdrawal of a certain quantity of fluid he injects through the needle a certain amount of sterilized air. A radioscopic examination is then made, and if the case is one of abscess of the liver, the clear zone produced by the injected air is separated from the clear image of the lungs by the arciform shadow of the diaphragm, whereas this is not so in the case of pleural effusion, the appearances then produced resembling more those of pyopneumothorax, the fluid being freely movable within the thoracic cavity. The method is ingenious, but we should think hardly necessary in the majority of cases, and not without risk.

Dry Pleurisy.—The presence of thickened pleura can be made out on radioscopic examination. The shadow cast is not as dense as that of fluid, and there is no displacement of the heart.

The excursion of the diaphragm may be affected in several ways. The tendency is to a general limitation of movement. In some cases it may have an unusual curve.

In our experience acute pleurisy without effusion casts no shadow, and, as a rule, the rays will not be needed as an aid to the diagnosis of the condition.

The points which will help us to say that a given shadow is due to thickened pleura, and not to pulmonary consolidation, are (1) the absence of roof-tile appearance, (2) the absence of alteration in breadth of the chest on the affected side, and (3) the absence of cardiac displacement.

CHAPTER V

PNEUMONIA — EMPHYSEMA — PNEUMOTHORAX — BRONCHITIS—ABSCESS OF LUNG—HYDATID OF LUNG—NEW GROWTH—CARCINOMA OF ŒSOPHAGUS

Pneumonia.—The affected part of the lung in pneumonia casts a shadow, the density of which corresponds to the degree of consolidation. The excursion of the diaphragm is shortened, and if the consolidation be very extensive its outlines may be obliterated.

The diagnosis between consolidation and pleural effusion has already been discussed, and it will not be necessary to return to it here ; but it must be remembered that the heart may be displaced to some extent by a massive pneumonia, and also that the right side is frequently enlarged, a condition which must not be mistaken for displacement to the right. In a great majority of cases the X rays will not be necessary in making a diagnosis of pneumonia, but there are doubtful cases in which they may be extremely useful—as, for instance, when the physical signs are indefinite or equivocal. Williams in his book cites a case in which, after careful examination by two physicians and his house physician, a diagnosis of cerebrospinal meningitis was made. An X-ray examination at once revealed the true state of affairs, the darkened lung and restricted movement of the diaphragm being easily made out. We have observed a similar case.

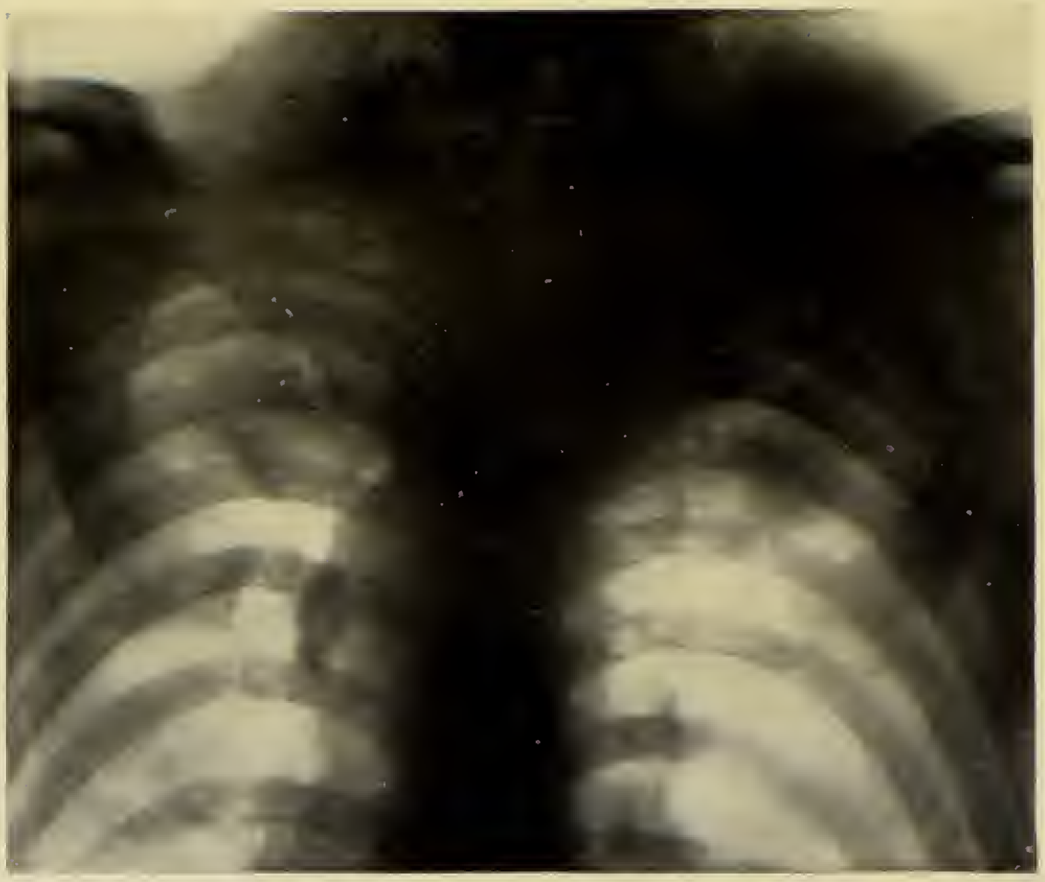
The rays are especially useful in pneumonias of central origin, as in these cases there may be no sign on percussion, whereas on the fluorescent screen the consolidated area can be well seen. This method is also very useful in the pneumonias of the aged, in which the fever may be absent and the signs indefinite. Resolution can be watched ; as a rule, there is some loss of transradiancy for some time after all physical signs have cleared up.

Emphysema.—In this disease the rays are extremely serviceable. The screen examination is the more useful. A diagnosis can be readily made on X-ray examination alone. The points which enable us to diagnose the condition are the following. The transradiant areas occupied by the lungs are brighter and more extensive than in health, the ribs standing out with unusual clearness, and instead of preserving their normal angle, being practically horizontal in direction. For this reason there is very little increase in the brightness of the pulmonary area on deep inspiration. The diaphragm is at a lower level than usual, and its movements on quiet respiration restricted. In forced expiration, however, it may be raised to a higher level than normal. The cardiac shadow stands out with marked distinctness, and the borders, which it may be practically impossible to make out by percussion, can be accurately determined. Especially is this the case with the right side of the heart, which is so often dilated in this disease. The heart is lower in the chest than normal and its axis more vertical, consequently there is far less than the usual alteration of its position on deep inspiration. Moreover, in our opinion the absence of cardiac dulness in cases of emphysema is due in great part to this vertical position of the heart. In the lateral examination the heart is seen to be farther from the sternum than in the normal chest, owing to the interposition of emphysematous lung between it and the chest wall. Emphysema, then, makes it easier than usual for the rays to detect any pulmonary consolidation or cardiac enlargement, whereas it hinders or may render impossible their detection by percussion.

Pneumothorax.—The appearances seen in pneumothorax are very striking. The unusual clearness of the affected side, the displaced mediastinum and collapsed lung, have already been discussed under pyopneumothorax; in some cases there is a marked depression of the diaphragm on the affected side. Small circumscribed areas of pneumothorax can sometimes be seen after exploratory puncture.

Bronchitis.—There is very little that is distinctive in this disease on X-ray examination. In many cases the lungs appear quite normal, and we do not think the rays are of any service, unless it be to detect some coexistent disease such as tuberculosis, or new growth, which is masked by the signs of bronchitis. This we have been able to do on several occasions.

PLATE XIII.



New Growth of Lung (Sarcoma).

The appearances are not unlike those seen in pulmonary tuberculosis, but note much coarser masses. (Plate back of Chest.)

[*To face p.* 47.

Abscess of the lung can be well made out by an X-ray examination which is especially indicated when the abscess is a central one, in which case there may be no signs on percussion. We know a case of a doctor who came up from the country to consult a physician about his chest. He was told that nothing definite could be made out. He went home, and next day coughed up about a pint of pus. Such a collection of pus could hardly have been missed had a careful X-ray examination been made, and points to the rule that in doubtful cases this procedure should not now be neglected.

In cases where pus is suspected it is a good plan before giving a final opinion to raise the tube first as high as the patient's head and then as low as the pelvis. If the layer of fluid be very thin, the shadow cast will be more marked when the rays penetrate it obliquely, and so be less liable to be overlooked.

Finally, more accurate information as to where to make the puncture or incision for the purpose of evacuating the contents of an abscess can more often be obtained by X-ray examination than by the ordinary physical signs.

Hydatid Cysts.—Valuable information can sometimes be gained by an X-ray examination in the case of hydatid of the lung, the clear-cut, rounded outlines of the cyst seen in some cases being very suggestive.

New Growth.—Intrathoracic new growth casts a shadow on the fluorescent screen. If very extensive the shadow may be very dense, and not unlike a pleural effusion, but the gradual decrease in density from below upwards cannot be made out ; nor is there the same displacement of the heart and diaphragm. In other cases there is marked mottling, not unlike that in pulmonary tuberculosis, but on closer inspection it can be seen, as a rule, that the mottling is coarser, and often large masses can be made out which are not usually seen in the case of pulmonary tuberculosis (Plate XIII.). Moreover, the distribution of the mottling is often characteristic. Again, there are cases in which the shadow is not unlike that cast by thoracic aneurysm. We have seen one such example, in which post-mortem a mass of glands was found at the root of the lung, casting a shadow, which, from a study of the skiagram only, could not have been distinguished from aneurysm (see Chapter VII., p. 57).

In the great majority of cases, however, there is no resemblance on X-ray examination between the appearances seen in new growth and in aneurysm. The diagnosis between these two conditions can, as a rule, be easily made (*cf.* Plates XIII. and XIV.), although in some cases at least this may be almost impossible by the usual methods.

In new growth of the thoracic parietes the X rays may be extremely useful in some cases to determine whether the growth has extended within the thoracic cavity or not. In such, a careful examination of the clear retrosternal triangle in the left lateral position should never be omitted.

Carcinoma of the Œsophagus.—We have lately seen four consecutive cases of carcinoma of the œsophagus which present characters so similar that it is possible that they may be diagnostic of this disease. All showed exaggeration of the left lateral aortic bulge and a thin, diffuse shadow extending to the right, beginning at the base of the heart and extending upwards to merge finally into the aortic shadow. This diffuse shadow is apparently a displacement of the mediastinal shadow to the right.

The seat of stricture can often be shown by giving the patient a cachet of bismuth to swallow immediately before the examination is made, when the dark shadow of the bismuth will be visible on the screen ; or if aneurysm can be excluded, some form of opaque bougie may be passed. The left posterior oblique position is the best one in which to examine the œsophagus.

CHAPTER VI

THE HEART—PERICARDIAL EFFUSION

Mention has already been made of the accuracy with which the borders of the heart can be determined by X-ray examination, provided there be no coexistent pleurisy or pulmonary consolidation sufficient to mask its shadow. It will be well now to consider in more detail the methods of examination and the behaviour of the normal heart so far as it can be made out by radioscopy.

The screen examination is the most useful one, and the two positions most generally adopted are the anterior and left lateral.

With the general appearances seen in the anterior examination we are already familiar (Plate III.). The outlines of the heart are seen most distinctly on deep inspiration, for the reason that the diaphragm descends and the lungs become brighter. During this act, too, the heart moves downwards and inwards, and the right border becomes more distinctly visible to the right of the sternum. On expiration the long axis of the heart becomes more horizontal, on deep inspiration more vertical. During deep inspiration, too, the transverse diameter of the heart becomes somewhat diminished and the amplitude of the pulsations somewhat lessened.

In the left lateral examination the retrosternal space is seen to widen and lengthen on full inspiration, the heart moving downwards and the upper part backwards.

Advantages of X-ray Examinations over Percussion.—We think there can be little doubt that in cardiac estimations more accurate results can be obtained by an X-ray examination in many cases than by percussion. We do not say in all cases, for it has already been pointed out that in some the borders may be masked by coexistent pulmonary or pleural conditions. Some very interesting tables are given by Williams (91) in his book to show the errors of percussion, which it will not be out of place to quote briefly. His method was to compare the width of the heart as found in the clinical record with the weight of the heart as determined by the post-mortem examination. He says: "It is obvious that this method of comparison may err, for a heart may be so distended during life as to give a large cardiac area to percussion, although it may not weigh much more than normal. On the other hand, if the weight of the heart is much increased, it must have been enlarged during life."

Five hundred and forty-six cases were used—370 men and 176 women. These are divided into six groups each, according to their weight, the men and women being classed separately.

Heart Weights compared with Heart Widths.

Men: Average Weight in Health, 290 *Grammes.*

Group I.

Weights below 225 grammes, 9 cases.
7 area normal by percussion.
1 area enlarged by percussion. Small size not recognised in 88 per cent.

Group II.

Weights 225 to 349 grammes, 168 cases.
11 area diminished by percussion.

Group III.

Weights 350 to 399 grammes, 74 cases.
56 area normal by percussion.
6 area diminished by percussion.
No enlargement recognised in 83 per cent.

Group IV.

Weights 400 to 449 grammes, 26 cases.
15 area normal by percussion.
1 area diminished by percussion.
No enlargement recognised in 61 per cent.

Group V.

Weights 450 to 499 grammes, 24 cases.
9 area normal by percussion.
No enlargement recognised in 37 per cent.

GROUP VI.

Weights 500 grammes and over, 69 cases.
18 area normal by percussion.
1 area diminished by percussion.
No enlargement recognised in 27 per cent.

Women : Average Weight in Health, 260 *Grammes.*

GROUP I.

Weights below 200 grammes, 8 cases.
7 area normal by percussion. Small size not recognised in 87 per cent.

GROUP II.

Weights 200 to 324 grammes, 99 cases.
12 area enlarged by percussion.*

GROUP III.

Weights 325 to 374 grammes, 26 cases.
In 17 area normal by percussion.
1 area diminished by percussion.
No enlargement recognised in 69 per cent.

GROUP IV.

Weights 375 to 424 grammes, 15 cases.
5 area normal by percussion.
2 area diminished by percussion.
No enlargement recognised in 46 per cent.

GROUP V.

Weights 425 to 474 grammes, 12 cases.
4 area normal by percussion.
1 area diminished by percussion.
No enlargement recognised in 41 per cent.

GROUP VI.

Weights 475 grammes and over, 16 cases.
1 area normal by percussion.
1 area diminished by percussion.
No enlargement recognised in 12 per cent.

---

* The weights of these twelve hearts were as follows: One weighed 230 grammes, two 245, one 250, one 260, one 270, one 280, four 300, one 315.

These tables, then, are sufficient to show that the error by percussion is a very considerable one, the more so since in this series of cases those who were very obese or the subjects of emphysema were as far as possible excluded, percussion being at a great disadvantage in such cases.

Dr. Franze of Nauheim, in discussing the functional power of the heart, states (32) : " The size of the heart is, therefore, the *best*, although *no absolute*, criterion for estimating its functional capacity ; but it must be measured for this purpose with exactitude. To do this by percussion is impossible. Only by use of the Röntgen rays—by the method known as 'orthodiagraphy'—can it be achieved."

The principles of orthodiagraphy or orthodiascopy have already been alluded to (p. 13), and it is in the case of heart measurements that it reaches its most useful practical application, since the greatest circumference of the organ being about 3 inches from the surface of the chest, the magnification of the shadow due to central projection is very considerable. Now, although orthodiagraphy is probably the most accurate method at present at our disposal for measuring the cardiac outlines, nevertheless it is not strictly accurate. To be absolutely correct it is necessary for the plane of the greatest circumference of the organ examined and the plane upon which its shadow is marked to be parallel to one another. If this be not so, then the tracing will be somewhat smaller than the object (see Fig. 12, where the object B E is greater than B C, and yet would give a tracing of the same size, L K). In the case of the heart, then, this source of error comes into play, as we have no means of determining the plane of the greatest circumference in different subjects. The error, however, is very slight or practically nil, except in the case of great dilatation of the left side, when the orthodiagram will be somewhat too small.

Some difference of opinion exists as to the period of respiration at which the orthodiagram should be made, and the middle phase of respiration is that chosen by most observers. We, however, prefer to make the tracing during deep inspiration, for the reason that the lungs are brighter and the cardiac borders more distinct. For the same reason we prefer the upright to the recumbent position of the patient. Fixation of the patient in the upright position to prevent rotatory lateral or up and down movements, which would, of course, vitiate results, can easily be obtained by an arrangement such as is used in conjunction with Guilleminot's stand (Fig. 11).

In cases where the upright position cannot be employed fixation is easily carried out by placing the patient on a canvas stretcher with the tube below. The Moritz orthodiagraph is, however, the only one which can be used in this position. Whichever method be adopted, the position and phase of respiration during which the tracing was made must be carefully noted, as the transverse measurement of the heart is somewhat less on deep inspiration than in expiration, and in the upright than in the recumbent position. The tracing can be made either on the skin of the patient or on a piece of cardboard placed between the screen and the surface of the chest.

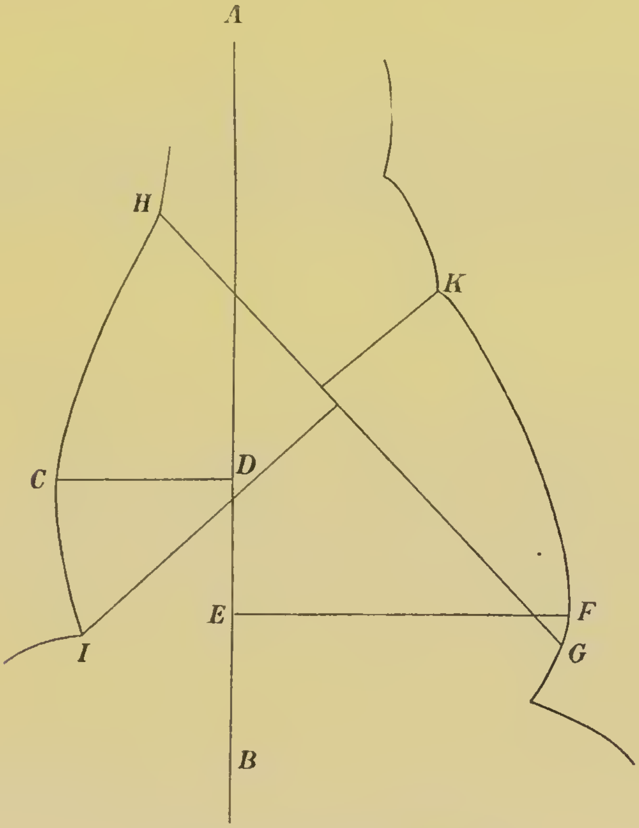


Fig. 16.—After Franze.

With Guilleminot's apparatus a piece of ground glass is placed in front of the screen and the tracing made on this. We have found, however, that the outlines are somewhat blurred when ground glass is used in front of the screen, and have lately been using a clear glass. This is drawn upon by special pencils, which can be obtained for the purpose, the drawings on the glass being afterwards transferred to tracing-paper. The tracing-paper used by Guilleminot is ruled in centimetre squares.

The middle line of the body and level of the diaphragm should always be marked, and some of the more prominent outlines of the bony framework will also be useful as points of reference.

It is better to mark the outlines by a series of dots and join these up than attempt to draw a continuous contour during the examination.

The measurements of an orthodiagram are carried out as follows (Fig. 16): The line A B is the middle line of the body; two lines, C D and E F, are drawn at right angles to A B to the borders of the heart on either side most distant from A B. The total, C D, E F, will be the "transverse dimension" of the heart. The line G H, drawn from the apex G to the point where the shadow of the vena cava superior meets that of the right auricle at H, designates the entire length of the heart. The point H, however, is not always easy to make out. Two lines at right angles to this line G H, one from the junction of the border of the right auricle with the diaphragm I, and one from the junction of the border of the pulmonary artery with that of the left ventricle K, when added together are said to constitute approximately the diameter of the right ventricle. The point K, like H, is often very difficult to make out.

In the left lateral examination the antero-posterior diameter can be mapped out in a similar manner in some cases, but is a much more difficult task, and the results obtained are not so satisfactory as in the case of the transverse diameter.

Williams gives the average width of the heart in men as 11·6 centimetres, in women as 11·2 centimetres.

Levy Dorn (69) gives the width in relation to height of the individual as:

Height.	Diameter of Heart.
1·25 inches.	9 centimetres.
1·5 ,,	11 ,,
1·75 ,,	12 ,,

The upper part of the cardiac shadow is continuous with that of the large vessels, while the lower part is continuous with that of the diaphragm. The absolute upper and lower limits cannot, therefore, be accurately ascertained.

Although there can be little doubt as to the value and accurate information which can be obtained by X-ray orthodiagraphic examination of the heart, the literature on the subject is at present very scanty, and much work has to be done in this direction.

Mitral Stenosis.—The heart in mitral stenosis takes a very peculiar shape ; in fact, cases of mitral stenosis might be picked out from other cases of morbus cordis with the screen. It may be described as purse-shaped, this form of heart being produced by the hypertrophy and dilatation of the right side over and above that of the left. Fig. 17 is a reduced tracing of an actual skiagram of a case of mitral stenosis.

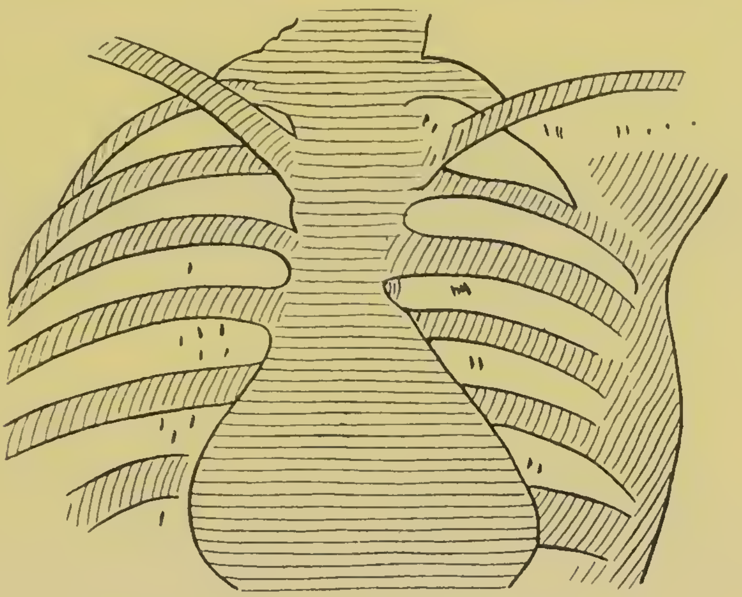


Fig. 17.—Heart in Mitral Stenosis.

The state of the heart in pulmonary tuberculosis, emphysema, and other conditions has already been mentioned.

Pericardial Effusion.—The appearances will vary with the amount of effusion present. When large amounts of effusion are present, the shadow of the cardiac area is increased and its outlines are somewhat rounded and different from the normal outlines. The pulsations of the left border are notably diminished, and may be obliterated, which, of course, is not the case in cardiac hypertrophy. The cardio-phrenic space, also (p. 20), is obliterated in small effusions. An inclination of the patient to one or other side might modify the cardiac outlines ; the patient should, therefore, be examined in different positions. A careful study of the retrocardiac triangle in the left lateral examination should not be omitted, as, if this triangle is well marked, there is probably not much, if any, effusion present.

Congenital Morbus Cordis.—In the few cases we have examined, we have in some ventured to exclude pulmonary stenosis, on account of the small size of the heart as shown by radioscopy; whether correctly or not, we are at present unable to say, and our observations have hitherto been too few to enable us to draw any definite conclusions.

Auscultation and radioscopy, used together, may give information in some cases of cardiac disease which will be more valuable than if either method were used separately. This combined method has been found very useful in timing murmurs in some cases, the cardiac systole being watched on the screen while listening with the stethoscope.

CHAPTER VII

THORACIC ANEURYSM

In the diagnosis of thoracic aneurysm the X rays reach one of their most successful practical applications. The diagnosis by the ordinary methods is in many cases extremely difficult and in some absolutely impossible; with the aid of the Röntgen rays, however, a satisfactory conclusion can as a rule be arrived at. Since the introduction of the right anterior oblique method of examination, mistakes are uncommon, as by its means most of the fallacies which exist when the anterior and posterior examinations only are employed can now be avoided.

The **screen examination** is by far the most important in these cases; in fact, it is impossible to give a decided opinion in any case if this examination be neglected. We would insist that no single skiagram out of a series obtained illustrating aneurysm is by itself sufficient for the diagnosis, even when additional ones are taken (*cf.* Plates X. and XVII.). The screen examination is often tedious and troublesome, owing to the thickness and muscular development of the great bulk of the patients suffering from this disease, but when it can be carried out satisfactorily is always sufficient, the skiagram being useful only as a permanent record of what has been observed by radioscopy. Before giving a final opinion in any given case the anterior, the posterior, and the right anterior oblique examinations should all be employed, and in some cases the left lateral, as, although after an experience of a large number of cases the shadows observed in the anterior and posterior examinations show a certain regularity which enables one to feel fairly certain of the existence of an aneurysm, yet in certain cases mistakes are sure to arise if our suspicions are not confirmed by the other examinations mentioned, especially the right anterior oblique.

Let us take first the appearances seen in the anterior and posterior examinations. In these positions, as has been stated (p. 19), the normal aorta is almost or entirely masked by the central opacity, with the exception of the left lateral aortic bulge, which is not in evidence in all cases.

In the case of thoracic aneurysms there will be seen certain more or less great, dark shadow-masses projecting to the right or left or both sides of the central opacity, at varying height and varying depth from the surface, limited, as a rule, by sharp, somewhat rounded and often pulsating borders (Plates XIV. and XVII., and Figs. 20, 21, 22).

These shadows will, of course, unless mapped out by orthodiascopy, always be exaggerated, the amount of exaggeration varying with the distance of the sac from the chest wall (see Fig. 12, p. 13). The density of the shadow will vary partly with the size of the aneurysm and partly with the amount of laminated clot. The greater the amount of organized clot the denser the shadow.

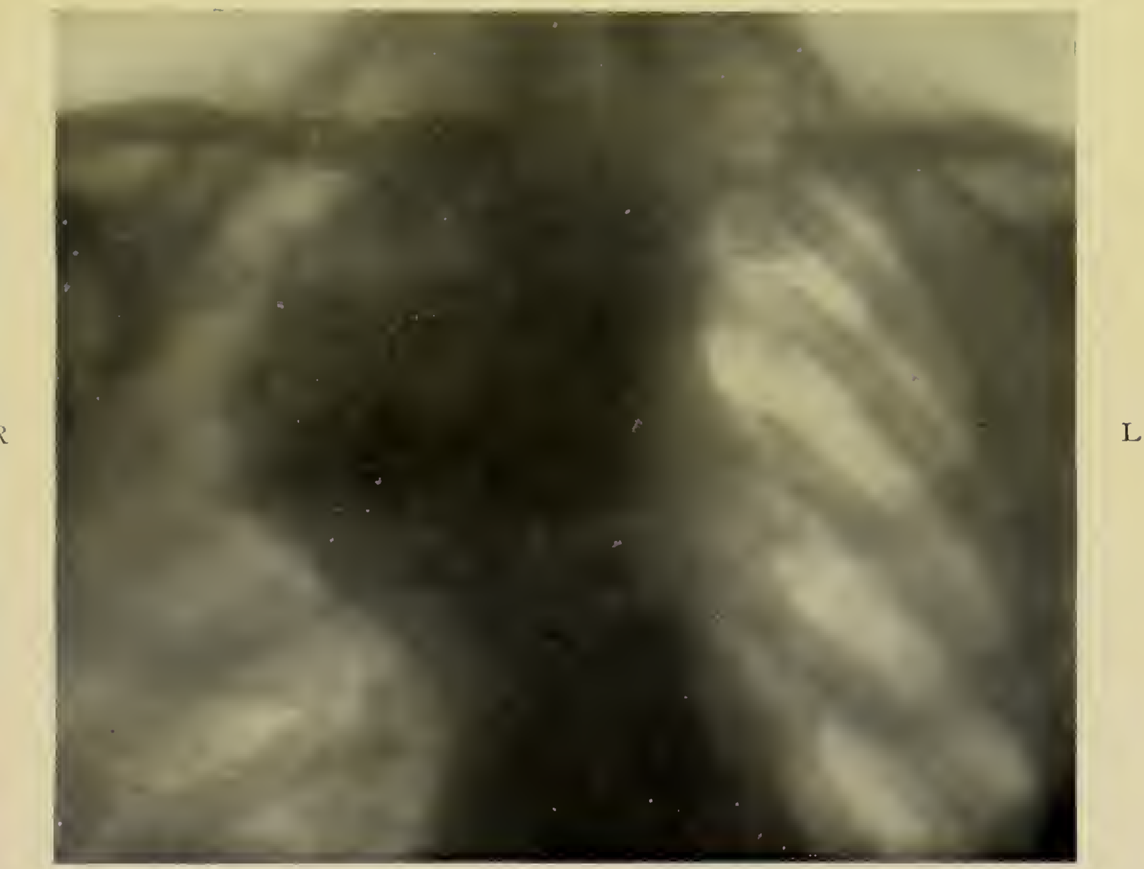
The position on the screen of the upper and lower limits of the shadow will, of course, alter with the position of the tube, unless the sac be in actual contact with the surface of the chest examined. To determine the accurate level, then, we must again have recourse to orthodiascopy.

The approximate depth of an aneurysm from the surface of the chest can be fairly easily determined, and gives additional information as to the point of origin. For it has been found that, as a rule, a shadow projected to the right of the central opacity, which lies nearer the front of the chest than the back, indicates an aneurysm of the ascending aorta; whereas a similar projection to the left, which lies nearer the back than the front, makes an aneurysm of the descending aorta more probable.

There are several ways in which, during the screen examination, information as to the depth of an aneurysmal sac from the surface may be obtained.

1. If with the screen held on the front of the chest the tube be shifted laterally (this can easily be done with Guilleminot's stand), it will be seen that the shadows of the anterior portions of the ribs remain quite immovable. The edge of the shadow of the aneurysm will, however, travel in a lateral direction to a varying extent, in a direction opposite to that in which the tube has been shifted. The nearer the sac be to the surface, the less will be the distance traversed by its shadow. In other

PLATE XIV.



ANEURYSM OF ASCENDING PART OF AORTIC ARCH.

The great exaggeration of the aortic shadow to the right is well shown.
(Plate front of Chest.)

[*To face p.* 58.

COLLEGE

words, the sac lies nearer that surface on which its edge when projected makes lesser lateral excursion when the tube is shifted.

2. Another method is to rotate the patient so as to examine the same shadow both from in front and behind. It will be understood from what has previously been said that the nearer to the surface the sac the sharper will be the outlines and the less exaggerated the shadow. If, then, a shadow is smaller and more sharply outlined on one surface than on the other, it may be presumed that the sac is nearer that surface on which its shadow is the smaller.

3. Also, if the size of a shadow of a right- or left-sided sac increases upon rotation to the same side, or decreases upon rotation to the opposite side, the sac lies nearer that half of the chest upon which it is projected, and if the change in size takes place in the opposite way, the sac lies nearer the opposite half.

4. If it be found, on shifting the tube up and down, or from side to side, that the shifting of the tube and that of the shadow are equal, the sac lies approximately in the centre between screen and tube; not in the centre between the anterior and posterior walls of the chest.

More exact localization than this is not possible, but this is sufficient for all clinical requirements.

One is often asked to give an opinion as to whether or not an increase in size of the sac has taken place at different examinations. To do this with any pretence to accuracy an orthodiascopic examination is absolutely essential. This can be carried out with Guilleminot's apparatus or the Moritz orthodiagraph. When Guilleminot's apparatus is employed a piece of thin ground glass or transparent paper is laid on the screen, and the normal ray is then conducted round the shadow and the outline drawn by hand at the same time on the paper or glass in front of the screen. The more prominent outlines of the bony framework of the chest should also be drawn, to serve as points of reference when subsequent examinations are made.

Pulsation.—There has been a good deal of controversy as to the value of pulsation in the diagnosis of aneurysm, and it has been claimed that an abnormal shadow originating in the mediastinum can only be taken to be an aneurysm when an expansile pulsation can be made out, but this is absurd. When it can be made out it is, of course, strongly in favour of aneurysm, but clinically it has long been known that an aneurysmal sac does not necessarily exhibit any pulsation. Aneurysms which have led to the wearing away of the bony walls of the chest may cause protusions on the surface which show neither visible nor perceptible pulsation. Karewsky has described a case of a tumour in the neck which showed no pulsation, and from which, upon puncture, blood flowed slowly and not in jets. It was operated upon as a cyst, and turned out to be an aneurysm of the common carotid artery. This absence of pulsation is not difficult to understand when one considers the great thickness of the walls, in some cases brought about by chronic inflammation on the outer side and by the organization of the blood-clot within.

That expansile pulsation has been observed in certain lymphoid and dermoid cysts which may exist in the upper mediastinum must not be forgotten, but such rarities are hardly to be considered. Pulsation of the pronounced arterial type seen in a generally dilated aorta, especially in aortic insufficiency, is but rarely seen in aneurysm, a point that may be of value in the differential diagnosis between these conditions and aneurysm. An energetic pulsation contra-indicates aneurysm, the diastole of the sac being rarely so energetically and rapidly carried out as in aortic insufficiency ; in fact, in a large number of cases of aneurysm pulsation is made out with difficulty, and often cannot be observed without making use of the lead diaphragm to limit the illuminated surface on the screen.

The comparison of two pulsations in relation to their phase—that is, ventricle action and the pulsation of a shadow in the upper mediastinum—forms one of the hardest tasks in radioscopy, and is in many cases impossible.

Pulsation on the right side of the central opacity is, as a rule, harder to make out than on the left. This may be accounted for by the fact that the border is here properly formed by the descending vena cava, which in these cases may be abnormally distended, through general or local engorgement due to compression by the aneurysmal sac.

In the foregoing passages we have spoken of the appearances seen in the two anterior and posterior examinations only, and these are the only ones which so far have received much attention in the English literature on this subject. We will now pass on to consider the appearances seen in the "right anterior oblique examination" (Fig. 18) first described by Holzknecht (55) in 1901.

This examination is one of absolute importance in the diagnosis of aneurysm, and should never be omitted in doubtful cases. Now, although practically all aneurysms are seen in this direction in the form of definite and often characteristic silhouettes, the strong point of the method lies in the way in which by its means we are enabled to demonstrate the presence of small commencing aneurysms, which may be masked by the "central opacity" in the ordinary anterior or posterior examinations; and, again, to distinguish between aneurysm and a generally dilated aorta, which before the introduction of this method was not always possible. The general appearances seen in this examination have already been described (Chapter II., p. 23), and it has been stated that the ribbon-like aortic shadow in the normal state has parallel sides and a rounded upper extremity (Fig. 18, D).

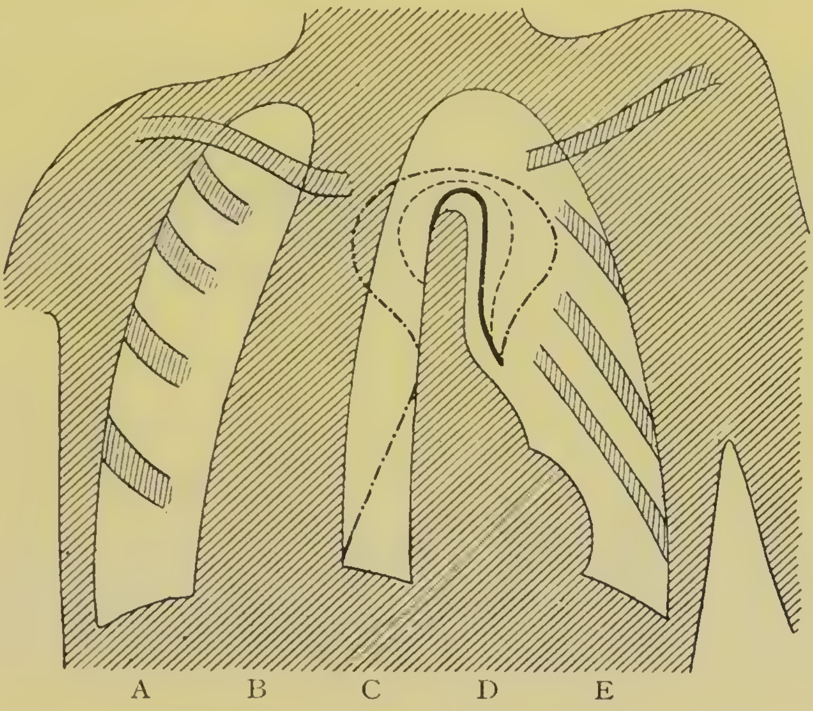


Fig. 18.—Right Anterior Oblique Position (after Holzknecht.)

A, clear area, corresponding to right lung; B, shadow of vertebral column; C, clear middle space; D, shadow of normal heart and aorta; E, clear area corresponding to left lung. ━━━, dilated aorta; -------, small commencing aneurysm; —·—·—·, upper part, larger aneurysm; —·—·—·, lower part, position of dilated auricle.

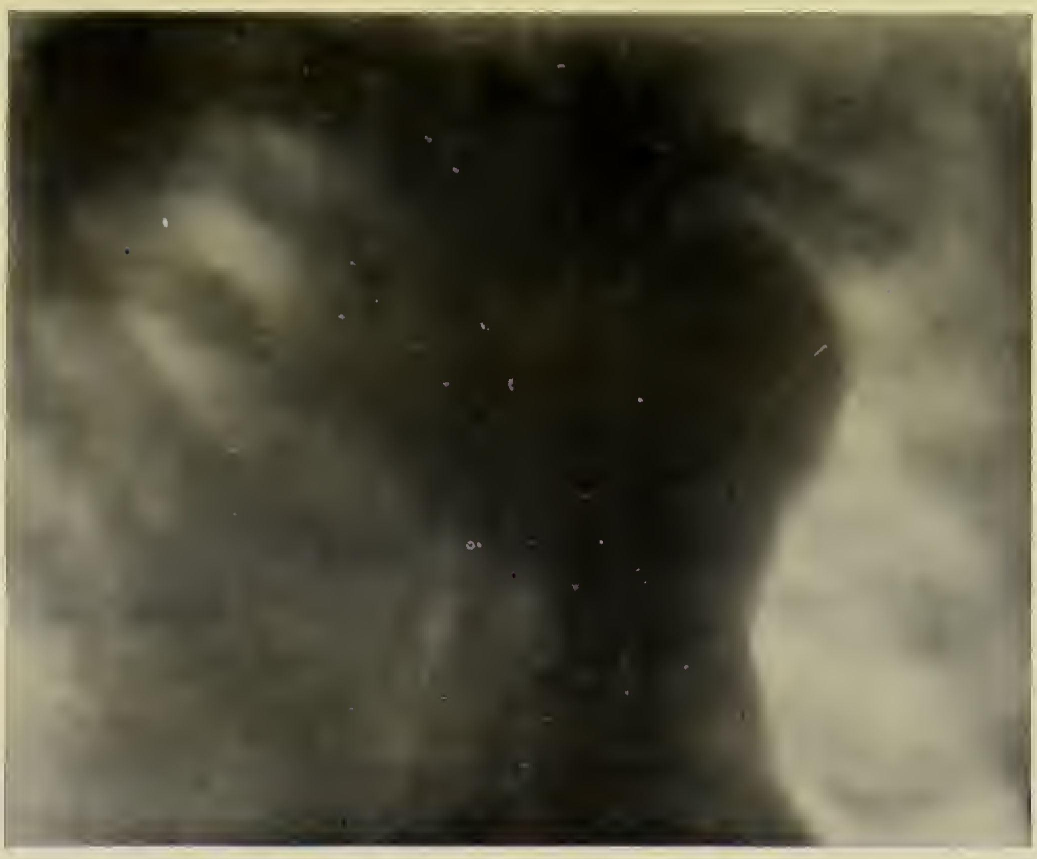
Now in the case of even small aneurysms of the aorta this "aortic shadow band" becomes club-shaped, and we can distinguish in it more or less clearly a head portion and a neck portion (see Fig. 18, ------- and Plate XV.), the neck portion being, as a rule, somewhat broader than the normal aortic shadow. The size of the head portion varies with the size of the aneurysm, and according to the direction of growth, it may be more marked anteriorly, projecting into the clear area occupied by the left lung, or posteriorly, when it may entirely fill up the upper portion of the clear middle space (Fig. 18, — - — - — -), and may even cross over the vertebral shadow and occupy a portion of the clear space which corresponds to the right lung.

In aneurysms of the commencement of the ascending arch the position of the head and neck portions may be reversed, there being a broad shadow which sits on the heart, as it were, like a cap, and then tails off again into the narrow aortic shadow band.

Now, in many cases, especially in patients suffering from arterial degeneration, when the peripheral vessels are thickened and tortuous, the left lateral aortic bulge becomes considerably exaggerated, and the aortic shadow may be visible even to the right of the central opacity, thus simulating a medium-sized aneurysm. We have seen several cases in which an aneurysm had been diagnosed on the skiagraphic appearances thus presented, although such a condition certainly did not exist. It is a common pitfall, and will continue to be so unless the right anterior oblique examination be employed more generally than is at present the case. The figure given by Williams (91) in his book (p. 311) is very misleading, and certainly cannot be regarded as typical of aneurysm. We have frequently seen an aortic shadow as exaggerated as the one in question in cases where an aneurysm could be excluded. Let us now consider how this error may be avoided.

In Fig. 19, No. 3, the two parallel lines represent the central opacity in the ordinary anterior or posterior examination; the shaded portions that part of the aortic arch which casts a shadow to either side of this central opacity. The appearance thus presented resembles that observed in the case of medium-sized aneurysms of the arch. If now the patient be rotated into the right anterior oblique position, the disappearance of this apparently large aneurysmal sac is remarkable, and we see in this position an aortic shadow band (Fig. 19, No. 4, and Fig. 18, ▬▬▬), which is somewhat broader and perhaps reaches to

PLATE XV.



Aneurysm of the Aortic Arch in Right Anterior Oblique Position.

The head portion and neck portion and clear space between the aortic and vertebral shadows are easily made out.

[*To face p.* 62.

a somewhat higher level than in the normal picture, but still, nevertheless, retains its parallel borders, showing that the aorta is the seat of a general dilatation and not of a true aneurysm. A glance at Fig. 18 will probably make these points clearer than if we attempted to describe the appearances in detail. Fig. 19, No. 1, represents the normal aorta in the antero-posterior examination; the parallel lines represent the central opacity; and the shaded portions the portion of the aorta which projects beyond this central opacity—namely, the left lateral aortic bulge. In No. 2 the parallel lines represent the vertebral shadow, the shaded part the normal aorta seen in the right anterior oblique examination. Nos. 3 and 4, as has already been mentioned, represent the appearances which may obtain in the case of a generally dilated aorta; Nos. 5 and 6, the appearance seen in aneurysm; Nos. 7 and 8, a small aneurysm springing from the under surface of the arch, which could not be detected by X-ray examination either in the anterior or posterior or right lateral oblique examinations, the appearances presented being practically indistinguishable from those seen in Nos. 1 and 2, the normal aorta. Nos. 3 and 4 also serve to illustrate another pitfall into which not a few have fallen—namely, that of regarding the whole breadth of the shadow in the anterior or posterior examination as due to the aneurysmal sac; to take the case of No. 3, for instance, the length and breadth of the aorta is increased. It describes in consequence a circle of greater radius, and for this

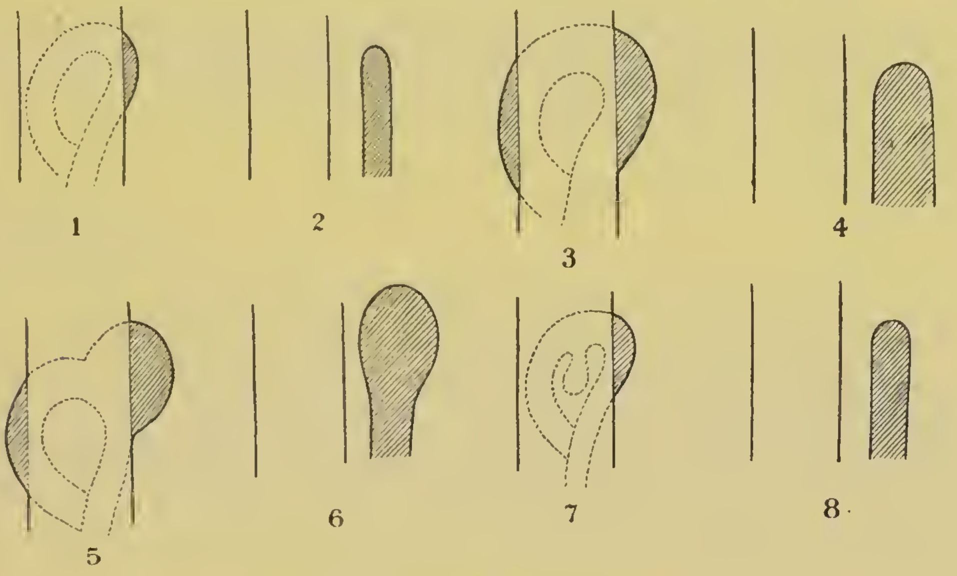


FIG. 19.—AFTER HOLZKNECHT.

reason extends beyond the central opacity on both sides. As, however, on radioscopic examination only those parts which project beyond the central shadow are visible (shaded portions in figure), and both may show single pulsation, this arouses the suspicion that they belong to a single spherical pulsating body, since the dotted internal contour of the arch concealed by the central shadow remains invisible. When this is borne in mind, however, the reason for the apparent remarkable diminution in the size of the sac on transition from the antero-posterior to the right anterior oblique position becomes at once evident.

The bright area separating the heart and aorta from the shadow of the vertebral column is never completely filled by the shadow of an aneurysm, the lower part always remaining clear, unless covered or darkened from another cause, such as dilatation of the auricle (Fig. 18, —-—-—-, lower part).

It will here be well to point out that a slight bulging may be present in the extremity of the normal aorta shadow band in some few cases, but the marked clubbing due to aneurysm is never seen.

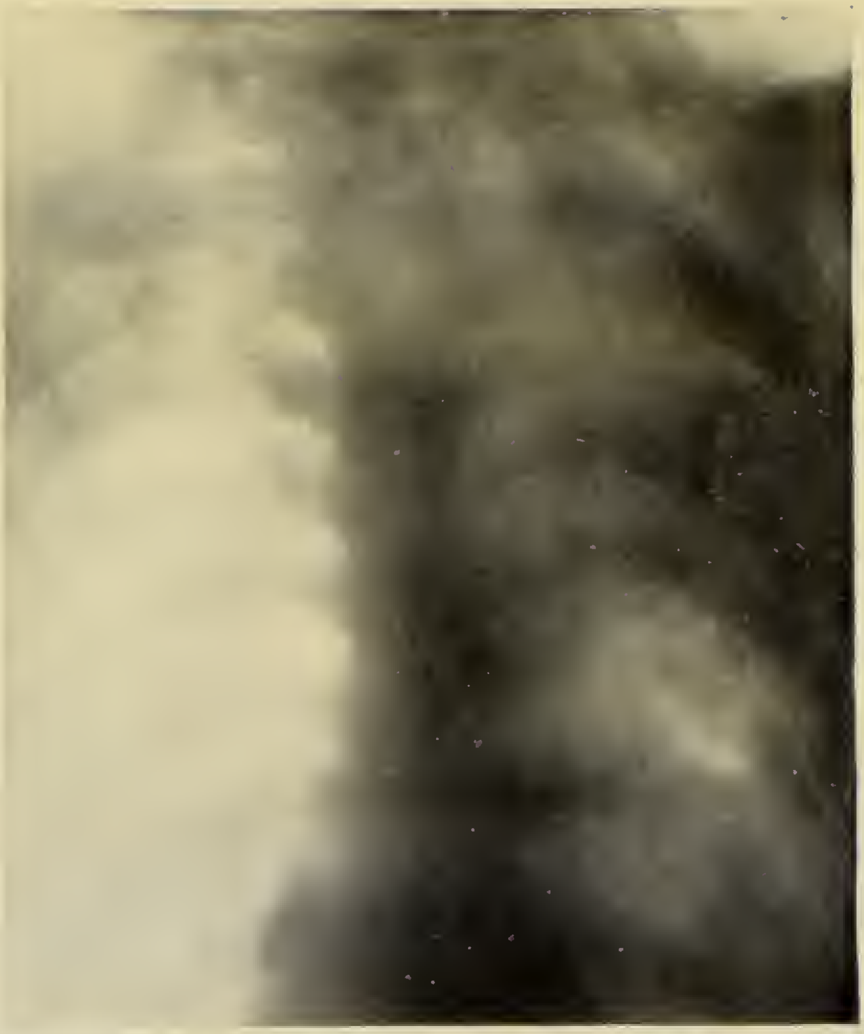
We think we have now said sufficient to show the great value of this oblique examination, and we cannot too strongly insist upon its importance in doubtful cases, especially in small commencing aneurysms.

The Left Lateral Examination.—This position has nothing like the importance of the preceding in the diagnosis of aortic aneurysm, but may be useful in some cases, chiefly in aneurysms of the ascending arch, to determine the distance they project into the clear retrosternal triangle. In this position the inferior portions of the ascending and descending aorta can alone be seen, the shadow of the arch and upper portions being masked by the shadows of the shoulder and vertebral column.

Position of the Heart.—We have been much struck with the transverse position which the heart takes up in many cases of aortic aneurysm. That the heart is displaced downwards as a whole has been noted by most observers, but the transverse position we have not seen alluded to by any other writers. Nevertheless, it is such a marked feature in many cases, especially in aneurysm of the ascending arch, that we have come to look upon it as a very valuable aid to diagnosis in cases of doubt. No doubt the heart is pushed into this position by the supraincumbent weight of the aneurysmal sac, and the position is

PLATE XVI.

L



R

Extensive Pulmonary Tuberculosis, thought to be Aneurysm of Aortic Arch before X-Ray Examination.

The contrast between the dark shadowing of the affected side and clear unaffected side is well shown. (Plate back of Chest.)

[*To face p.* 65.

one which tends to raise rather than lower the apex, unless there be considerable dilatation of the right ventricle, which is the exception in aortic aneurysm. A careful examination of the heart, then, with the screen on the anterior surface of the chest should never be omitted, as we may gain additional important evidence by this means.

It will be unnecessary to point out all the difficulties which may arise in the diagnosis of aneurysm, but in our experience we have been enabled by means of the X rays to give a definite diagnosis of aneurysm in some cases where it was not suspected, to exclude it in some where it had been diagnosed, and to distinguish between it and a new growth. Five cases diagnosed as aneurysm have come under our observation which the X-ray examination showed to be pulmonary tuberculosis. Plate XVI. is one of them. Œsophageal stricture and obscure intercostal neuralgia are other disorders which we have shown by the X rays to be due to unsuspected aneurysm.

Illustrative Cases.

Case 1.—Gentleman, aged forty-five. Seen by three consulting physicians in London. Under treatment for intercostal neuralgia. Physical signs obscure. There was a little tenderness on percussion over the upper dorsal vertebræ. There was no dulness, no tracheal tugging; pupils equal; no cough; and

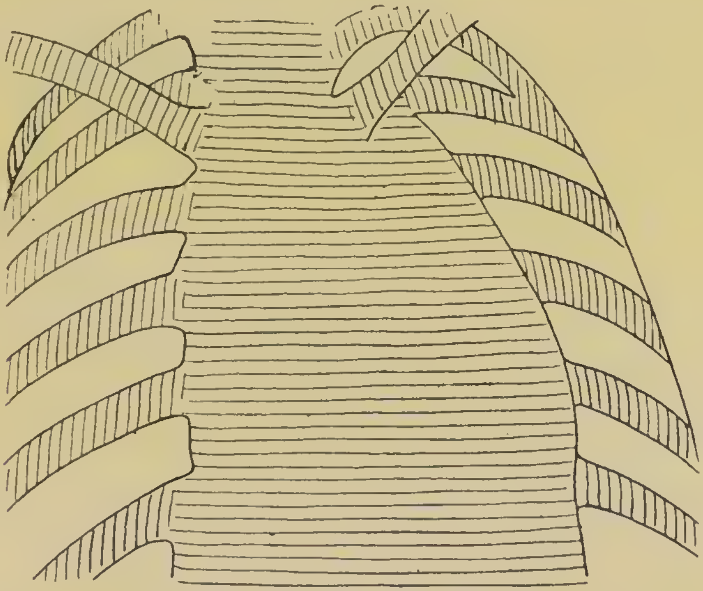


Fig. 20.—Reduced Tracing of Skiagram of Case 1.

only slight dyspnœa. X-ray examination with screen showed great exaggeration of aortic shadow to the left, and a diagnosis of aneurysm of the commencement of the descending portion of the arch was given. Fig. 20 is a reduced tracing from the actual skiagram taken at this time. Patient died three years later. X-ray diagnosis confirmed.

Case 2.—Woman, aged fifty-one. Came to out-patient department complaining of pain between the shoulders, and was admitted with signs of aortic regurgitation. Remained in hospital eight weeks, at end of which time discharged somewhat improved. No X-ray examination. Readmitted three years later in much the same condition, with exception that pain in back had increased. Pupils equal ; no tracheal tugging ; cords moved well ; no dulness to percussion. Fig. 21 is a reduced tracing of the actual skiagram taken at this time. Diagnosis of aneurysm of commencement of descending aortic arch given. Patient has since died, and the diagnosis was confirmed at the post-mortem examination.

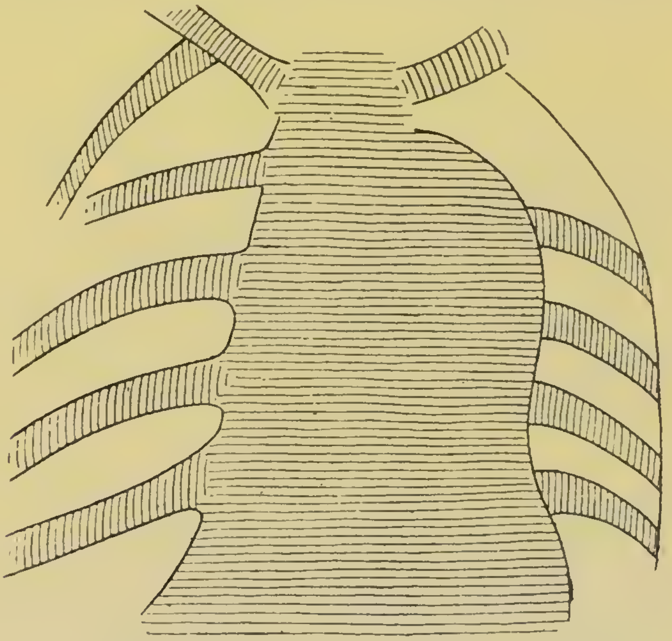
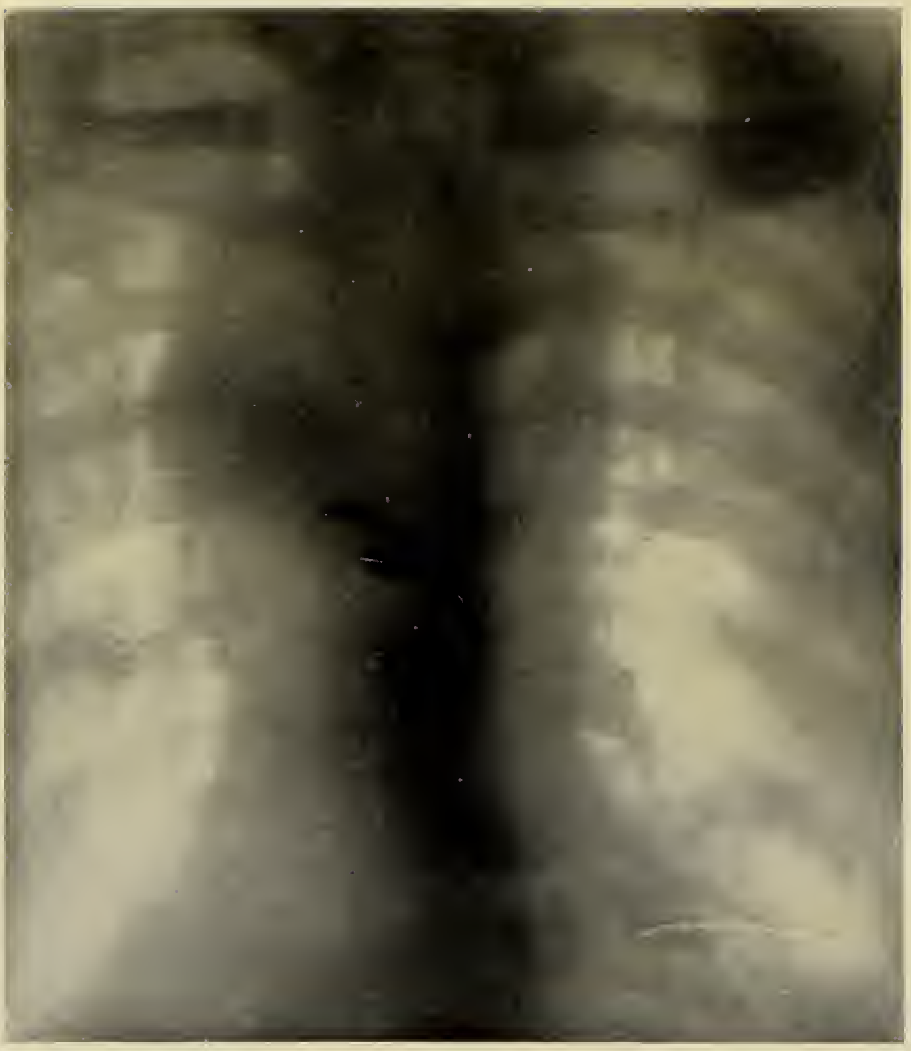


Fig. 21.—Reduced Tracing of Skiagram of Case 2.

Case 3.—Woman, aged fifty-eight. Admitted to hospital, having been sent up from the country with the diagnosis of laryngeal tuberculosis. On examination of larynx, left vocal cord found to be paralyzed, which, of course, in itself was a very suspicious sign of aneurysm. Nevertheless, no other symptom

PLATE XVII.



Aneurysm of Aorta. (*See Case* 4, *p.* 67.)
(Plate back of Chest.)

[*To face p.* 67.

or sign of aneurysm existed. It was only on X-ray examination that a large aneurysm of the transverse arch was found. Fig. 22 is a reduced tracing from the actual skiagram taken at the time.

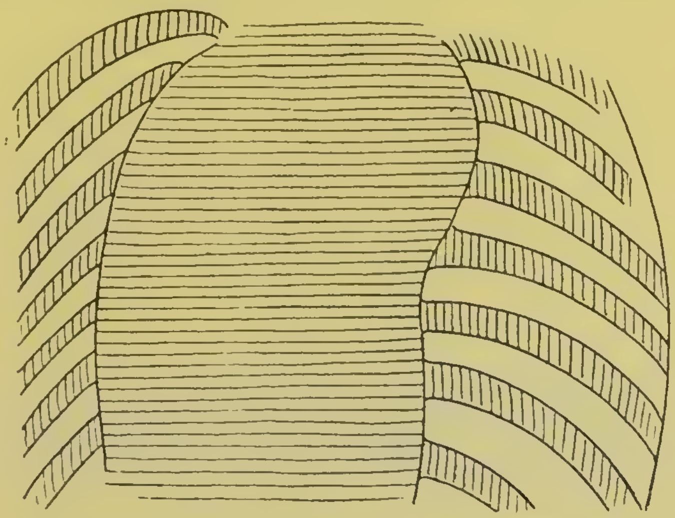


FIG. 22.—REDUCED TRACING OF SKIAGRAM OF CASE 3.

This patient has been lost sight of, so that diagnosis has not been confirmed.

CASE 4.—Gentleman, aged forty-two. Seen by two physicians. Diagnosis uncertain. Complains of cough, dyspnœa, and pain in the chest. Pupils equal; pulses equal; no tracheal tugging; no laryngeal paralysis; and no dulness to percussion. On auscultation, very localized patch of intense bronchial breathing in left suprascapular fossa.

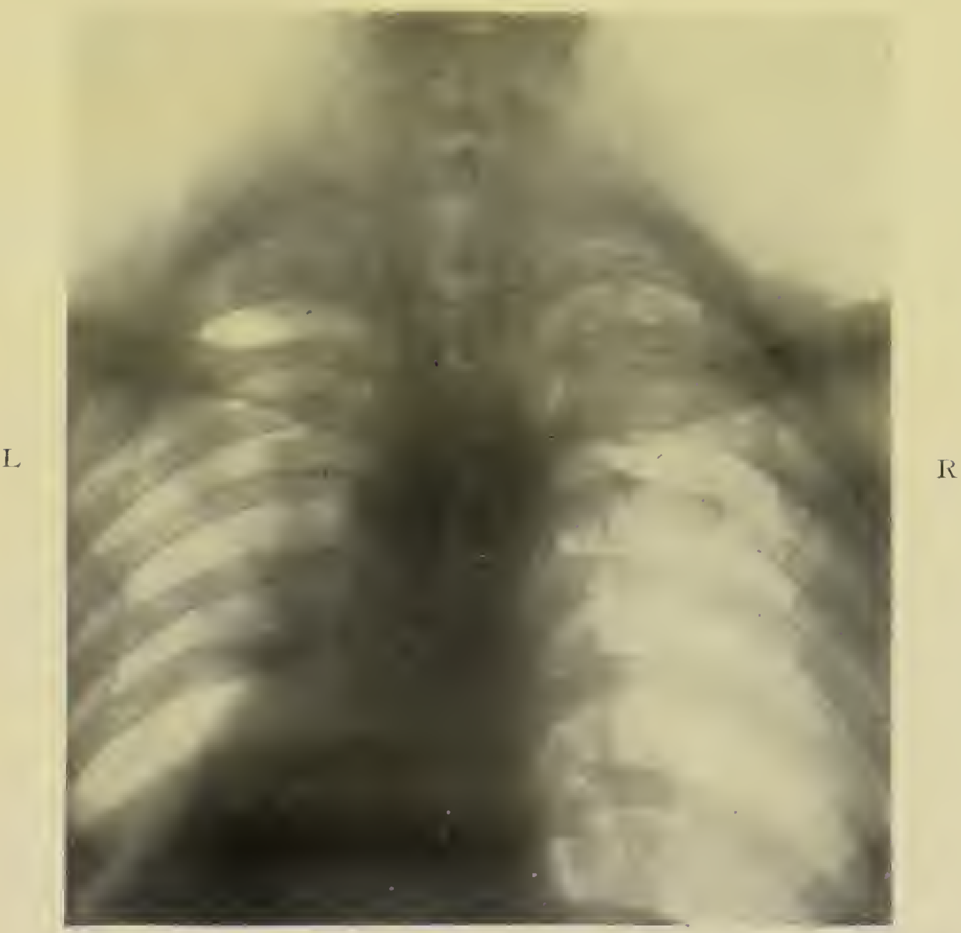
X-ray Examination.—Exaggeration of aortic shadow to both sides of central opacity. Skiagram taken at the time (see Plate XVII.). Diagnosis of aneurysm of aortic arch given. Patient died following day. Post-mortem it was found that X-ray diagnosis was correct. Aneurysm had ruptured into left pleura.

Other cases might be quoted, but it is thought that these will be sufficient to show the great value of this method.

In conclusion, we would wish to emphasize the importance to the operator of protecting himself as far as possible from the rays, for although no risk is run by the patient when the examination is carried out by a skilful radiographer, yet the constant and prolonged exposure of the operator when making a series of examinations is certain, if this precaution be neglected, to lead sooner or later to severe dermatitis, and other ill-effects which it is now known these rays are capable of producing.

The skiagram of which Plate XVIII. is a reproduction was taken from a case which came under our observation after the book had gone to press. The patient was sent to the X-ray department for an examination of the seventh cervical vertebra, which was thought to be the seat of caries. The X-ray examination showed such a definite mottled shadowing of both apices, which gave no signs to percussion and auscultation, that we have decided to insert it as a good illustration of Class I., p. 32.

PLATE XVIII.



Pulmonary Tuberculosis, both Apices.

(Plate back of Chest.)

[*To face p.* 68.

BIBLIOGRAPHY

[*The numbers before entries correspond with the reference numbers of text.*]

1 Achard : Sur le diagnostic des abcès du foie à symptômes pleuraux (1er Congrès Égyptien de Médecine, Le Caire, Décembre, 1902).

2 Achard and Grenet : Sur l'insufflation d'air dans les épanchements pleuraux (Soc. Méd. des Hôp., 17 Avril, 1903).

3 Bade (Peter) : Ueber die Röntgenuntersuchung bei du Lungentuberkulose (*Fortschritte auf dem Gebiete du Röntgenstrahlen*, Band 4, Heft 3, February 25, 1902).

4 Béclère (A.) : Les rayons de Röntgen et le diagnostic de la tuberculose. Paris, 1899 (Rapport présenté au IVe Congrès pour l'étude de la tuberculose. Paris, 1898).

5 Béclère (A.) : Les rayons de Röntgen et le diagnostic des affections thoraciques. Paris, 1901 (Rapport présenté au Congrès international d'électrologie et de radiologie médicales, Paris, 1900).

6 Béclère (A.) : Les rayons de Röntgen et le diagnostic des maladies internes. Paris, 1904.

7 Béclère (A.) : Étude physiologique de la vision dans l'examen radioscopique (*Arch. d'Élect. Méd.*, No. 82, 15 Octobre, 1899).

8 Béclère (A.) : L'examen radioscopique des plèvres interlobaires et le diagnostic de la sclérose de l'interlobe (*Presse Méd. des Hôp. de Paris*, 6 Juillet, 1900).

9 Béclère (A.) : Le déplacement pathologique du médiastin pendant l'inspiration étudié à l'aide des rayons di Röntgen (Soc. Méd. des Hôp. de Paris, 6 Juillet, 1900).

10 Béclère (A.) : Sur la mensuration du cœur à l'aide des rayons de Röntgen, principe d'une méthode nouvelle (Soc. Méd. des Hôp. de Paris, 1 Juin, 1900).

11 Béclère (A.) : Un cas de kyste hydatidique du poumon avec présentation de stéréodiagrammes et présentation du malade (Soc. Med. des Hôp., 26 Juin, 1903).

12 Béclère, Oudin et Barthélemy : Application de la méthode de Röntgen à l'examen d'un anéurysme de la crosse de l'aorte (Soc. Méd. des Hôp. de Paris, 5 Février, 1897, et 14 Mai, 1897).

13 Bedart : Diagnosis of Aneurism of the Aorta by X Rays (*Echo Médical du Nord*, 22 Janvier, 1905).

14 Bergonié et Carrière : Étude fluoroscopique des épanchements pleuritiques (*Arch. d'Électr. Méd.*, No. 79, 15 Juillet, 1899, and *Archives of the Roentgen Ray*, February, 1900).

15 Bonnet Léon : Sur l'emploi des rayons de Röntgen pour le diagnostic precoce de la tuberculose pulmonaire (Great Britain Congress on Tuberculosis, 1902).

16 Bouchard : La pleurésie de l'homme étudiée à l'aide des rayons de Röntgen (C.R. de l'Acad. des Sciences, 7 Décembre, 1896).

17 Bouchard : Les rayons de Röntgen appliqués au diagnostic de la tuberculose pulmonaire (C.R. de l'Acad. des Sciences, 14 Décembre, 1896).

18 Bouchard : L'application de la radioscopie au diagnostic des maladies du Thorax (C.R. de l'Acad. des Sciences, 28 Decembre, 1896, et 17 Mai, 1897).

19 Bouchard : L'ampliation de l'oreillette droite pendant l'inspiration, démontrée par la radioscopie (C.R. de l'Acad. des Sciences, 24 Janvier, 1898).

20 Bouchard : Quelques points de la physiologie normale et pathologique du cœur relevés par l'examen radioscopique (C.R. de l'Acad. des Sciences, 8 Août, 1898).

21 Bouchard et Balthazard : Le cœur à l'état normal et au cours de la grossesse (C.R. de l'Acad. des Sciences, 1 Décembre, 1902).

22 Bouchard et Balthazard : Le cœur chez les tuberculeux (C.R. de l'Acad. des Sciences, 2 Février, 1903).

23 Bouchard et Balthazard : Le cœur à l'état pathologique (C.R. de l'Acad. des Sciences, 16 Mars, 1903).

24 Bouchard et Balthazard (*Lancet* report, October 21, 1905) : International Congress on Tuberculosis, Paris, 1905.

25 Claude : Application des rayons X au diagnostic de la tuberculose (IV^{e} Congrès pour l'étude de la tuberculose, Paris, 1898).

26 Cowl : Ueber verschiedine Projektionen des Thorax und über den diagnostischen Weit von Aufnahmepaaren (*Fortschritte auf dem Gebiete du Rontgenstrahlen*, Band v., Heft 2, 19 December, 1901).

27 Destot : La tuberculose au début et la radioscopie orthogonale (*Bull. Méd.*, 31 Janvier, 1903).

28 Espina y Capo : Le diagnostic précoce de la tuberculose (IV^{e} Congrès pour l'étude de la tuberculose, Paris, 1898).

29 Espina y Capo : Importance of X Rays in the Early Diagnosis of Tuberculosis (Great Britain Congress on Tuberculosis, 1902).

30 Fernet : Déplacement du cœur par lésion ancienne du poumon droit (Société Médicale des Hôpitaux, 11 Décembre et 18 Décembre, 1896).

31 Flamencourt : Les rayons X et l'exploration de l'aorte thoracique, 1902 (Thèse de Doctorat, Paris, 1903).

32 Franze (Paul) : Estimation of the Functional Power of the Heart by the Aid of Orthodiagraphy (*Edinburgh Med. Journ.*, March, 1906).

33 Franze (Paul) : A Note on Orthodiagraphy (*Archives of the Roentgen Ray*, July, 1905).

34 Franze (Paul) : Orthodiagraphy (*Medical Elect. and Radiol.*, June, 1906).

35 Gardiner : X Rays as a Diagnostic Agent in Phthisis Pulmonalis (*Scottish Medical and Surgical Journ.*, November, 1902).

36 Gibson : Some Cases of Aneurism (*Practitioner*, May, 1905).

37 Green : The Early Diagnosis of Pulmonary Tuberculosis by the Röntgen Rays [*a*] *Brit. Med. Journ.*, November 4, 1905, and [*b*] March 17, 1906).

38 Green : A Plea for the More Extended Use of the X Rays as an Aid to the Diagnosis of Pulmonary Tuberculosis (*Archives of the Roentgen Ray*, April, 1906).

39 Green : Clinical Society's Transactions, 1904 ; and The Diagnosis of Pulmonary Tuberculosis by X-Ray Examination of the Thorax (*Med. Elect. and Radiol.*, December, 1905).

40 Grognard : Le cœur à l'état normal : étude de radioscopie orthogonale (Thèse de Doctorat, Lyon, 1903).

41 Grunmach : Die Röntgenstrahlen in Dienste der inneren Medizin (*Berlin Klin. Woch.*, No. 25, 1896).

42 Grunmach : Sur les progrès réalisés dans les sciences médicales à l'aide de la radioscopie et de la radiographe (Congrès international d'électrologie et de radiologie médicale, Paris, 1900).

43 Grunmach : Die Radiographie und Radioscopie der inneren Organe (Rapport au Congrès de Berne, 1902).

44 Guilleminot : Dispositif permettant d'obtenir le graphique des projections normales en radioscopie clinique (*Arch. d'Élect. Méd.*, No. 95, 15 Novembre, 1900).

45 Guilleminot : Mode opératoire pour obtenir les projections orthogonales radioscopiques (*Arch. d'Électr. Méd.*, No. 119, 15 Novembre, 1902).

46 Guilleminot : Mensuration des diamètres et de l'aire du cœur sur l'écran radioscopique sans graphique. Dispositif noveau s'adoptant à un écran quelconque (*Arch. d'Éléctr. Méd.*, No. 120, 15 Décembre, 1902).

47 Guilleminot : Rapport sur l'état actuel de l'orthodiagraphie (Assoc. Française pour l'Avancement des Sciences, Congrès d'Angers, 1903).

48 Guilleminot : The Exploration of the Thorax by Orthodiagraphy (*Archives of the Roentgen Ray*, November and December, 1905, and January, 1906).

49 Guilloz : Diagnostic des dextrocardies par la radiographie (*Revue Méd. de l'Est*, 15 Mars, 1901).

50 Halls Dally : On the Use of the Röntgen Rays in the Diagnosis of Pulmonary Disease (*Lancet*, June 27, 1903).

51 Halls Dally : The Early Diagnosis of Pulmonary Tuberculosis by the Röntgen Rays (*Brit. Med. Journ.*, December 2, 1905).

52 Hennecart (Sedan) : The Diagnosis of Pulmonary Tuberculosis by the X Rays (International Congress on Tuberculosis, Paris, 1905).

53 Hickey : The Interpretation of Radiographs of the Chest (*The Archives of Physiological Therapy*, May, 1905).

54 Hoffmann : Ueber Skiametische Untersuchung am Herzen (16 Kongress für Innere Medizin).

55 Holzknecht (Guido) : Die röntgenologische Diagnostick der Erkrankungen der Brusteingeweide, Hamburg, 1901.

56 Holzknecht (Guido) : Ein Neues radioskopisches Symptom die Bronchialstenose (*Weiner Klin. Rundschau*, 1899, No. 45).

57 Holzknecht (Guido) : Das radiographische Verhalten der normalen Brustaorta (*Wiener Klin. Wochenschr.*, 1900, No. 10).

58 Holzknecht (Guido) : Zum radiographischen Verhalten pathologischen Prozesse der Brustaorta (*Wiener Klin. Wochenschr.*, 1900, No. 25).

59 Holzknecht (Guido) : Ueber Mitewegung eines intrathoracischen Tumours beim Schluckakt (*Wiener Klin. Rundschau*, 1900, No. 15).

60 Holzknecht (Guido) : Zur Diagnose der Œsophagusstenose (*Deutsche Med. Wochenschr.*, 1900, No. 36).

61 Kelsch et Boisson : Note sur le diagnostic précoce des affections tuberculeuses du thorax par le radioscope (*Bull. de l'Acad. de Méd.*, 21 Décembre, 1897).

62 Kienböck : Auf dem Röntgenscheim beobachtete Bewegungen in einem Pyopneumothorax (*Wiener Klin. Wochenschr.*, 1898, No. 22).

63 Kienböck : Weiterer Bericht über Röntgenbefunde bei Pyopneumothorax (*Wiener Klin. Wochenschr.*, 1898, No. 51, and 1901, No. 19).

64 Kraft : Die Röntgenuntersuchung der Brustorgane, Strassburg, 1901.

65 Lawson (David) : A Further Contribution to the Uses of Röntgen Rays in the Study of Lung Diseases (*Med. Elect. and Radiol.*, March, 1904).

66 Lawson (David) : Some Changes which take place in the Lungs and Pleura, chiefly in Pulmonary Tuberculosis, as shown by Skiagraphy (Roy. Med. Chir. Soc. Trans., 1905).

67 Lawson and Hill Crombie : Röntgen Rays in the Diagnosis of Lung Disease (*Lancet*, July 25, 1903).

68 Leo (H.) : Nachweis eines Osteosarkoms der Lungen durch Röntgen strahlen (*Berlin Klin. Wochenschr.*, April 18, 1898).

69 Lévy-Dorn : Zur Untersuchung des Hurens mittels Röntgenstrahlen (Verhandlungen des Kongresses für innere Medizin, 1899, and *Fortschritte a. d. Geb. d. Rontgensts.*, p. 216, 1898 ; Berlin Med. Soc., March 28, 1900).

70 Maragliano : Recherches sur les rayons de Röntgen (Congrès de Naples, October 20, 1897).

71 Maragliano et Caffareno : *Gazette delli Osped. et delle Clin.*, January 6, 1901.

72 Mignon : Examen du Médiastin par les rayons de Röntgen (Congrès international d'électrologie et de radiologie médicales, Paris, 1900).

73 Mignon : Étude anatomo-clinique de l'appareil respiratoire et de ses annexes par les rayons de Röntgen (Thèse de Doctorat, Paris, 1898).

74 Mignon : Des rayons de Röntgen dans le diagnostic de la tuberculose (communié au IV^{e} Congrès pour l'étude de la tuberculose).

75 Milian : Diagnostic de la symphyse pleurale par les rayons de Röntgen (*Presse Médicale*, 26 Juin, 1897).

76 Moritz : Ueber Veränderungen in die Form, Grösse und Lage des Herzens beim Uebergang aus horizontaler in vertikale Körperstellung (*Deutsches Archiv für Klinische Medizin*, Band 82).

77 Moritz : Methodisches und Technisches zur Orthodiagraphie (*Deutsches Archiv für Klinische Medizin*, Band 81).

78 Moritz : Ueber Orthodiagraphische Untersuchungen am Herzen (*Münchener Med. Wochenschr.*, No. 1, 1902).

79 Moritz : Ergebnisse der Orthodiagraphie für die Herz-perkussion (19 Kongress für Innere Medizin).

80 Moritz : Eine einfache Methode, etc., und die Bestimmung der Herzgrösse, etc. (18 Kongress für Innere Medizin).

81 Moritz : Orthodiagraphie (*Münchener Med. Wochenschr.*, No. 29, 1900).

82 Salle : Note sur l'emploi des rayons de Röntgen chez les jeunes soldats pour déceler les lésions ignorées du cœur ou des poumons (en particulier la tuberculose) (Soc. Méd. des Hôp., 14 Mars, 1902).

83 Santiard : Étude de l'aire de projection du cœur sur la paroi thoracique par la radioscopie (Thèse de Doctorat, Paris, 1900).

84 Variot et Chicotot : Mensuration de l'aire du cœur par la radioscopie (C.R. de l'Acad. des Sciences, 24 Juin, 1898).

85 Variot et Chicotot : Étude radioscopique des mouvements d'oscillation du cœur chez l'enfant, etc. (Soc. Méd. des Hôp. de Paris, 17 Mars, 1899).

86 Variot et Chicotot : Le diagnostic de la pneumonie franche chez l'enfant par la radioscopie (Soc. Méd. des Hôp., 2 Juin, 1899, et 22 Décembre, 1899).

87 Weinberger (Maximilian): Ueber die Rontgenographie des normalen Mediastinums (*Zeitschr. für Heilkunde*, Neue Folge, 1900, Wien).

88 Weinberger (Maximilian): Atlas der Radiographie der Brustorgane. Wien und Leipzig, 1901.

89 Weinberger (Maximilian): Ueber die Untersuchung der Brustkrankheiten mit Röntgenstrahlen (Congrès de Berne, 1902).

90 Weinberger (Maximilian): Ueber die durch Erweiterung der Pulmonal-arterie in Röntgenbilde entstehende Schattenform (Congrès de Berne, 1902).

91 Williams (Francis): The Röntgen Rays in Medicine and Surgery, New York and London, third edition, 1903.

92 Williams: *Boston Med. and Surg. Journ.*, October 1, 1896.

93 Williams: Location of the Right and Left Borders of the Heart, etc. (*Boston Med. and Surg. Journ.*, June 21, 1899).

94 Williams (Francis): Allbutt, System of Medicine, second edition, vol. i.

95 Williams (Francis): Trans. of Med. Soc. of State of New York, January, 1898.

96 Williams (Theodore): International Congress on Tuberculosis, Paris, 1905.

97 Ziemssen und Rieder: Die Röntgenographie in der inneren Medizin, Bergmann, 1901.

INDEX

ABSCESS of liver, method of diagnosing from pleural effusion, 43
— of lung, diagnosis by X-ray examination, 47
— — value of method, 47
Achard, method of diagnosing between pleurisy and liver abscess, 43
Aged subjects, pneumonia of, X rays useful in diagnosis, 45
Aneurysm of common carotid artery mistaken for cyst, owing to want of pulsation, 60
— thoracic, diagnosis by X rays, definitely confirmed in some cases, and definitely excluded in others, 65
— — diagnosis by X rays, from intrathoracic new growth, 47
— — — illustrative cases, 65-67
— — — anterior and posterior examination, 57-60
— — — — localization of depth of aneurysm by shifting tube and rotating patient, 58, 59
— — — — method of determining increase in size of sac, 59
— — — — rotation into right anterior oblique position dispels illusion of aneurysmal sac, 62, 63
— — — — shadows seen must be mapped out by orthodiascopy, 58
— — — — value of pulsation in diagnosis, 59
— — — right anterior oblique examination, 60-64
— — — — value in demonstrating small commencing aneurysms, 61
— — — — value in distinguishing between aneurysm and generally dilated aorta, 61, 62, 63
— — — left lateral examination, 64
— — — — how far useful, 64
— — position of heart in, 64, 65
Aorta (thoracic), importance of study of, under right anterior oblique examination, 23
— — arch of, ascending aneurysm of, distinguished by position of shadow from aneurysm of descending aorta, 58
— — — — produces ribbon-like offshoot of cardiac shadow, 23
Aorta (thoracic), dilated, differential diagnosis from aneurysm by means of right anterior oblique examination, 61, 62, 63
— — — differential diagnosis from aneurysm by means of pulsation, 60
— — — mistaken for aneurysmal sac, 62
— — — — how to correct error, 62, 63
— — shadow of, forms part of median thoracic zone, 19
Aortic bulge (left lateral), 19
— — exaggeration of, in arterial degeneration, 62
— — — leads to simulation of aneurysm, 62
— — when more marked, 19
— shadow-band (ribbon-like), club-shaped appearance in aneurysms, 61
— — seen under right anterior oblique examination, 23
— — — — how produced, 23
Apparatus for examination of chest by X rays, 1-17
Artery (common carotid), aneurysm of, mistaken for cyst, owing to want of pulsation, 60
Auscultation and percussion, early tuberculosis indicated by X rays previous to, 32
— and radioscopy, combined use in cases of cardiac disease, 56
— — useful in timing murmurs, 56
Axillary fold (anterior), shadow produced by, 19, 20

Balthazard (of Paris) on estimated size of heart, 34
Barthélemy and Oudin first used X rays in examination of the heart, 2
Béclère (of Paris), authority on X rays, 2
— on luminous sensibility of observer's retina, 17
Béclère's seat for patients under examination, 11
Bergonie (of Paris), authority on X rays, 2
— and Carrière, on concave margin of shadow in empyema, 40, 41
Bibliography, 68-72
Bi-cathodal tube for control of current, 6, 9

Bismuth, cachet of, swallowed by patient before examination to determine seat of stricture in carcinoma of œsophagus, 48
Bonnet Léon (of Paris), authority on X rays, 2
— diaphragmatic sign of, 27
Bouchard, Prof. (of Paris), first studied pleurisy, pulmonary tuberculosis, and intrathoracic disease by X rays, 2
— — diagnosis of pulmonary tuberculosis by X rays, 26
— — on estimated size of heart, 34
Bronchial glands (enlarged) in pulmonary tuberculosis detected by means of X rays, 36
Bronchitis, X rays only of value in diagnosing presence of coexistent disease, 46

Calcification of lungs in tuberculosis detected by means of X rays, 36
Capillary attraction of fluid cause of curvature of shadow seen in empyema, 41
Carcinoma of œsophagus, diagnosis by X rays, 48
— how to determine seat of stricture, 48
Cardiac dulness, absence in emphysema due to vertical position of heart, 46
Cardio-phrenic space, appearance of, 20
— obliterated in small pericardial effusions, 55
Carrière and Bergonie on concave margin of shadow in empyema, 40, 41
Cavities in lungs in pulmonary tuberculosis detected by means of X rays, 35
"Châssis" (Guilleminot's), apparatus for securing free mobility of tube, fixation of screen and immobility of patient, 12, 13, 53, 58, 59
Chest, breadth of affected side in chronic lung disease and in pleural effusion, 43
— — — — in dry pleurisy, 44
— examination of, by X rays, 1-25
— — — apparatus, 1-17
— — — appearances seen under, 23, 24
— — — control over quantity, quality, and steadiness of rays emitted, 3-11
— — — historical note on, 1, 2
— — — luminous sensibility of observer, 3, 17
— — — means of altering relative position of tube, patient and screen, 3, 11, 12, 13
— — methods, 1-17
— — positions, 18-24, 49, 57-64
— — — anterior and posterior, 18, 19, 23, 49
— — — — appearances seen under, 18, 19
— — — — — relative differences under the two positions, 19
— — — — — thoracic zones, 18, 19
— — — — in diagnosis of thoracic aneurysm, 57-60
— — — left lateral, 49
— — — — chief use in determining antero-posterior diameter of heart, 24
— — — — in diagnosis of thoracic aneurysm, 64
Chest, examination of, by X rays, positions, right anterior oblique, appearances seen under, 23
— — — — — thoracic zones, 23
— — — — essential for studying thoracic aorta, 23
— — — — — — in diagnosis of thoracic aneurysm, 60-64
— — — — left posterior oblique, appearances seen under, 23
— — — — — chief use in examining œsophagus, 23
"Cog-wheel" respiration at apex in pulmonary tuberculosis, jerking and hesitating action of diaphragm associated with, 28
Congenital morbus cordis, examination under X rays, 56
Coil. See *Ruhmkorff coil* and *Section coil*
Crane (of Philadelphia), authority on X rays, 2
Crookes' tube. See under *Tube*
Cunningham, Professor, his opinion that shadowy lines on either side of mediastinal shadow are dependent on puckering of edge of pericardium, 21
Current, control of, by bi-cathodal tube, 6, 9
— — by high-tension rectifier, 6, 8
— — by valve-tube of Villard, 6
Cyst, aneurysm of common carotid artery mistaken for, owing to want of pulsation, 60
Cysts (lymphoid and dermoid) of upper mediastinum, expansile pulsation in, 60

D'Arsonval, experiments on quantity and penetration of rays, 8
Diaphragm, dome-shaped convexities of shadow, 21
— — — average excursion and incursion, 22, 23
— — — flattening of dome not observed in radioscopy, 21
— — — inequality in excursion and incursion on two sides, pathological, 22
— immobility of, in pulmonary tuberculosis on affected side, 28
— level of, to be marked on orthodiagram, 54
— movements of, in pulmonary tuberculosis, amplitude of, varies with situation of disease, 29
— — — increase on affected side after arrest established, 28, 29
— — — jerking and hesitating action, 28
— — — — associated with "cog-wheel" respiration, 28
— — — method of study, 29
— — — restriction of, 26, 27
— — — — early and frequent sign of tuberculosis, 26, 27
— — — — probable causes of phenomenon, 27, 28
— — — — value in diagnosis, 27

Diaphragm, movements of, in pulmonary tuberculosis, two examinations necessary in doubtful cases, 29
— — in dry pleurisy, limited, 44
— shadow of, diminished when stomach distended, 20

Electrical resistance of tube, methods of measuring, 7, 8
— — — penetration of rays dependent on degree of, 6, 7
Emphysema, absence of cardiac dulness in, due to vertical position of heart, 46
— density of shadows of tubercles due to transradiancy of lung in, 31, 32
— diagnosis by X rays, 46
— — appearances seen, 46
— — value of method, 46
— difficulty of detecting pulmonary consolidation or cardiac enlargement by percussion in, 46
— transradiant areas of lung brighter than in health, 46
Empyema, cardiac displacement in, 42
— curvature of upper margin of shadow seen in, 40
— — cause of, 41
— diagnosis of, by X rays, 40
— — — appearances less striking than in case of pyopneumothorax, 40
Equivalent spark, 7
Espino-y-Capo (of Madrid), authority on X rays, 2

Fibrosis of lungs detected by means of X rays, 36
Fluorescent screen, 2
— fixation of, by means of Guilleminot's "châssis," 12, 13
— relative value of appearances on, compared with those seen on photographic plate, 24. See also *Screen examination*
Franze (of Nauheim) on value of orthodiagraphy compared with percussion in measurement of heart, 52

Gaiffe's automotor mercury jet interrupter, for use with constant current, 4, 7
— high-tension transformer, 2
— milliampèremeter, 9
Gardiner on average excursion between expiration and inspiration, 22
Glass, advantage of clear over ground glass for making orthodiagram tracings, 53, 54
Green, Stanley, on position of shadow of diaphragm, 29
Guilleminot on size of heart in pulmonary tuberculosis, 34
— and Vannier, on average excursion between expiration and inspiration, 22
Guilleminot's "châssis" for securing free mobility of tube, fixation of screen and immobility of patient, 12, 13, 53, 58, 59
— — tracing-paper, 54
Gundelach's tube, 11

Halls Dally on cardio-phrenic space, 20
— on average excursion between expiration and inspiration, 22
Heart (antero-posterior diameter of) determined by left lateral examination, 24
— diminution in size in first and second stages of pulmonary tuberculosis, 34
— disease of, congenital, examination under X rays, 56
— displacement of, absent in dry pleurisy, 44
— — to side opposite to that on which fluid is present in pleural conditions, 42, 43
— — in pulmonary tuberculosis, 35
— — — more accurately determined by rays than by percussion, 35
— — towards affected side in pulmonary conditions, 42, 43
— enlargement of, emphysema renders detection by percussion difficult, 46
— examination of, by X rays, 49
— — — advantages over percussion, 49-52
— — — anterior and left lateral methods most useful, 49
— — — screen examination, 49
— measurement of, by orthodiagraphy, 52
— — — most accurate method at present known, 52
— ribbon-like offshoot of cardiac shadow seen under right anterior oblique examination, 23
— shadow of, borders masked in some cases by co-existent pulmonary and pleural conditions, 49
— — forms part of median thoracic zone, 19
— — in emphysema, 46
— — in mitral stenosis, purse-shaped, 55
— vertical position of, in emphysema, 46
— — — — causes absence of cardiac dulness, 46
— weight compared with width, 50-52
Hickey (of Michigan) on shadowy lines on either side of mediastinal shadow dependent on lungs, 21
High-tension rectifier for control of current, 6, 8
— transformer for excitement of tube, 2
Hill Crombie on difficulty of obtaining percussion note with "roof-tile" ribs, 35
Historical note on examination of chest by X rays, 1, 2
Holzknecht (of Vienna), authority on X rays, 2
— on importance of right anterior oblique position in study of thoracic aorta, 23
— on right anterior oblique examination in diagnosis of thoracic aneurysm, 60, 61
Homogeneous appearance of shadow in pleurisy with effusion, 39
Hydatid cysts, diagnosis by X-ray examination, 47

Hydrogen, permeability of platinum and palladium to, when red-hot, 10
— — — — principle of "Osmo regulator" dependent upon, 10

Immobility of patient under examination secured by Guilleminot's "châssis," 12, 13
Intercostal spaces, increase of, in pleurisy with effusion, 43
— — narrowing of, in "roof-tile" appearance of ribs, 35, 43, 44
Interrupters for use with alternating current, 4, 5
— for use with constant current, 3, 4
Intra-thoracic new growth, 47

Karewsky, case of aneurysm of common carotid artery mistaken for cyst, 60

Lattice-work effect caused by crossing of ribs, 19
— when more marked, 19
Lawson, David, fixation of diaphragm, 28
— position of shadow of diaphragm, 29
— on difficulty of obtaining percussion note with "roof-tile" ribs, 35
— experiments on concave margin of shadow in empyema, 41
— decreased space between ribs in pleural effusions, 43
Lead diaphragm, insertion between tube and patient useful in difficult cases of lung examination, 30
— necessity for use in determining presence of pulsation in thoracic aneurysm, 60
Lévy-Dorn, average width of heart in men and women, 54
Liver, abscess of, method of diagnosis from pleural effusion, 43
Luminous sensibility of observer, in examination of chest by X Rays, 3, 17, 30
Lung, abscess of, diagnosis by X-ray examination, value of method, 47
Lungs (apices of), failure in translucency, 29, 30
— — — — care needed in illuminating suspected side, 30
— — — — early sign of pulmonary tuberculosis, 30
— bilateral situation of tuberculosis detected by X rays, previously shown to be unilateral by physical methods, 32
— calcification of, in tuberculosis, detection by means of X rays, 36
— cavities in, in tuberculosis, detection by means of X rays, 35
— consolidation, emphysema renders detection by percussion difficult, 46
— diseases of, chronic: breadth of chest on affected side less than on sound side, 43
— — — diagnosis by X rays, points of differentiation from pleural conditions, 42
Lungs, fibrosis of, detected by means of X rays, 36
— transparent area of lateral thoracic zones (anterior and posterior examination), corresponds to, 19
— transparent area of three zones (right anterior oblique examination) corresponds to, 23
— transradiant areas of, in emphysema, brighter than in health, 46

Mammæ, shadow produced by, 20, 21
Mercury jet interrupter (Gaiffe automotor) for use with constant current, 4, 7
— — — (turbine), for use with constant current, 3, 4, 6
— — — with synchronous alternating current motor, for use with alternating supply, 8
Mignon (of Nice), authority on X rays, 2
Miller, Leslie, jointless section coil, 3
Milliampèremeter, measure of electrical resistance of tube by, 8, 9
— Gaiffe's, 9
— Schall's, 9
Mitral stenosis, purse-shaped shadow of heart seen in, 55
Moritz orthodiagraph only one employable when patient in recumbent position, 53
Mottling of shadow in intrathoracic new growth, 47
— — — in pulmonary tuberculosis, 30
Murmurs (cardiac), auscultation and radioscopy combined, useful in timing, 56

New growth (intrathoracic), diagnosis by X-ray examination, 47
— — — — diagnosis by X-ray examination from pulmonary tuberculosis and thoracic aneurysm, 47
— of thoracic parietes, diagnosis by X-ray examination to determine whether growth has extended into thoracic cavity, 48

"Osmo regulator" affixed to X-ray tubes, 10
— formation dependent upon permeability of platinum and palladium to hydrogen, when red-hot, 10
Œsophagus best seen under left posterior oblique examination, 23
— carcinoma of, diagnosis by X rays, 48
— — how to determine seat of stricture, 48
Orthodiagram, measurements of, 54
— method of making tracings, 53, 54
— middle line of body and level of diaphragm to be marked on, 54
— period of respiration suitable for making, 52
Orthodiagraph, 16
— Moritz's, only one employable when patient in recumbent position, 53
Orthodiagraphy, measurement of heart by, 52
— — — — most accurate method at present known, 52

Orthodiascopy, 52
— importance in mapping out shadows seen in thoracic aneurysm, 58
— method of procedure under, 15
— principles of, 13
— use of tracings in, 15, 16, 25
Oudin and Barthélemy, first used X rays in examination of the heart, 2

Palladium, permeability to hydrogen when red-hot, principle of formation of "Osmo regulator," 10
Penetration of rays, control of, 6
— dependent upon electrical resistance of tube, 6, 7
— measure of, in radioscopy by radiochromometer, 10
Percussion, advantages of X rays over, in examining heart, 49-52
— difficulty of detecting pulmonary consolidation or cardiac enlargement in emphysema by, 46
— less valuable than rays in demonstrating displacement of heart in pulmonary tuberculosis, 35
— See also *Auscultation* and *Percussion*
Pericardial effusion, appearances under X rays vary with amount of effusion present, 55
— cardio-phrenic space obliterated in small effusions, 55
— examination of patient under different positions necessary, 55
Photographic plate for radiography, 2
— relative value of appearances on, compared with those seen on fluorescent screen, 24
— value of cumulative action of X rays on, in diagnosis, 24
Physical signs, advantage of X rays over, in detecting pulmonary tuberculosis, 32, 33
Platinum, permeability to hydrogen when red-hot, principle of formation of "Osmo regulator," 10
Pleurisy with effusion, breadth of chest on side containing fluid, 43
— — diagnosis by X rays, 39
— — — points of differentiation from lung disease, 42
— — diagnosis between fluid above and below diaphragm, 43, 44
— — diagnosis from abscess of liver, 43
— — homogeneity of shadow in, 39
— — obliteration of clear space between outer end of diaphragm and chest-wall distinctive of, 42, 43
— — See also *Pyopneumothorax*
— dry, diagnosis of thickened pleura from pulmonary consolidation, 44
— — limitation of movements of diaphragm, 44
Pneumonia, density of shadow cast corresponds to degree of consolidation, 45
— diagnosis of, by X rays, 45
— — — not necessary in majority of cases, 45
Pneumonia, diagnosis of, by X rays, useful in pneumonias of aged, of central origin, and where physical signs doubtful, 45
Pneumothorax, diagnosis of, by X rays, 46
— — — appearances seen striking, 46
Position of patient under examination, 11, 12
— — for making orthodiagram, 52, 53
— — — recumbent, 53
— — — upright preferable, 52
Pulmonary vessels (larger): ill-defined, shadow-like lines on either side of mediastinal shadow, probably due to, 21
Pulsation, comparison of two pulsations in relation to their phase difficult, 60
— in dilated aorta, pronounced arterial type of, 60
— in thoracic aneurysm frequently absent or inactive, 60
— — — use of lead diaphragm necessary to determine, 60
— — — value in diagnosis, 59
Purse-shaped shadow of heart in mitral stenosis, 55
Pyopneumothorax, diagnosis by X rays, 40
— — easily made, 40
— horizontal position of upper margin of shadow, 39, 40
— level of fluid alters with position of patient, 40, 42
— rhythmical wavy movements seen, due to heart's action, 40, 42, 43
— splashing on surface of fluid well seen, 40

Radiation, steadiness of, and control over, attained by means of interrupters, 3-5
Radiochromometer, measure of penetration of tube in radioscopy, 10
Radiography, measure of electrical resistance of tube by milliampèremeter in, 8, 9
— permanent records of observations on fluorescent screen afforded by, 24
— photographic plate for, 2
— records static conditions, 24
— value of additional diagnostic evidence afforded by, 24
— value of, as aid to radioscopy in doubtful cases of pulmonary tuberculosis, 33
— (stereoscopic) method, 16, 17
Radioguide, use of, in orthodiascopy, 14
Radioscopy, measure of penetration of tube by radiochromometer in, 10
— records dynamic conditions, 24
— See also *Auscultation*
Ray of normal incidence, 14
Respiration, period of, at which orthodiagram should be made, 52
Retro-cardiac space seen by left lateral examination, 24

Retro-sternal angle, examination in lateral position important in new growth of thoracic parietes, 48
— space seen by left lateral examination, 24
Rheostat. See *Shunt rheostat*
Ribs, changes in position in pleural effusion, 42, 43
— — how differing from those in tuberculosis, 43
— See also *Intercostal spaces* and "*Roof-tile*" *appearance*
Röntgen, Professor Conrad, discovery of X rays by, 1
"Roof tile" appearance of ribs, absence in pleural effusion, 43
— — — in dry pleurisy, 44
— explains difficulty in obtaining percussion note, 35
— in pulmonary tuberculosis, 35, 43
Ruhmkorff coil for excitement of tube, 3

Sac (aneurysmal), dilated aorta mistaken for, 62, 63
— — how to correct error, 62, 63
— method of determining distance from chest wall, 58, 59
Sainte Claire-Deville and Troost discovered red-hot platinum and palladium to be permeable to hydrogen, 10
Scapulæ, shadow produced by, 19, 20
Schall's milliampèremeter, 9
Screen examination, importance in diagnosing thoracic aneurysm, 57, 58
— of heart under X rays, 49
— See also *Fluorescent screen*
Seat devised by Béclère for patients under examination, 11
Section coil (jointless), Leslie Miller's, 3
Shadow-like lines (ill-defined) on either side of mediastinal shadow, 20
— — probably due to larger pulmonary vessels, 21
— — recognition as normal shadows important, 21
Shadows cast by diseased portion of lung in pulmonary tuberculosis, 30
— — causes of, 30, 31, 32
— — stage of development at which lesion can cast a shadow, 31
Shunt rheostat for working Wehnelt interrupter, 3, 5
Spark-gap, both extremities to be pointed, 7
Static machine for excitement of tube, 2
Stereoscopic radiography, method of procedure, 16, 17
Sternum, shadow of, forms part of median thoracic zone, 18
Stomach, distension of, causes diminution of shadow of diaphragm, 20

Thoracic parietes, new growth of, 48
Tracing-paper (Guilleminot's), 54
Tracings for orthodiagram, method of making, 53, 54
Tracings, use of, in orthodiascopy, 15, 16, 25
Troost and Sainte Claire-Deville discovered red-hot platinum and palladium to be permeable to hydrogen, 10
Tube, 2
— apparatus to insure free mobility of (Guilleminot's "châssis"), 12, 13
— excitement by means of high-tension transformer, 2
— — by means of Ruhmkorff coil, 3
— — — — static machine, 2
— regulating devices for, 10
Tube (Gundelach's), 11
Tube-holder, 2
Tubercles, density of shadow in lung specially marked in cases of emphysema, 31, 32
— possessing definite cellular element capable of casting shadow in lung, 31
Tuberculosis (pulmonary), diagnosis, value of radiography as aid to radioscopy in doubtful cases, 33
— — diagnosis assisted by X rays, 26-38
— — — advantages of X rays over physical signs, 32, 33
— — — from intrathoracic new growth, 47
— — — illustrative cases, 36-38
— — — importance of double examination, 33
— — discoveries made by X rays, calcification, 36
— — — cavities in lungs, 35
— — — dark shadows cast by diseased portions of lung, 30
— — — diminution in size and alteration in position of heart, 34
— — — enlarged bronchial glands, 36
— — — failure in translucency of pulmonary apices, 29
— — — fibrosis, 36
— — — restricted movements of diaphragm, 26, 27

Valve-tube of Villard for control of current, 6
Vannier and Guilleminot on average excursion between expiration and inspiration, 22
Vertebral column, shadow of, forms part of median thoracic zone, 18
Villard's "Osmo regulator," 10

Watson's bi-cathodal tube for control of current, 6, 9
— high-tension rectifier for control of current, 6, 8
Wehnelt interrupter for use with constant current, 3, 4, 5
Williams, C. Theodore, diagnosis of pulmonary tuberculosis, 32
Williams, Francis (of Boston), authority on X rays, 2
— — average excursion between expiration and inspiration, 22
— — first description of heart shadow, 24

Williams, Francis (of Boston), restricted movements of diaphragm in diagnosis of pulmonary tuberculosis, 27
— — increased fluorescence of screen due to less blood, 30
— — pulmonary tuberculosis, diagnosis not detectable by X rays, 33
— — — — negative diagnosis obtained by X rays, 33
— — on fluid in triangular space in pleural effusions, 42
— — tables comparing heart weight with heart width, 49, 50, 51
— — average width of heart in men and women, 54
Zone (thoracic, median), (anterior and posterior examination) corresponds to shadow cast by vertebral column, sternum, and mediastinal contents, 18
— — — dark in appearance, 18
Zones, right and left lateral (anterior and posterior examination), correspond to lungs and crossed by shadows of ribs and clavicles, 19
— — — transparent in appearance, 19
Zones (thoracic) (right anterior oblique examination), correspond to area of lungs, 23
— — clear in appearance, 23

H. K. Lewis, 136, *Gower Street, London, W.C.*

CATALOGUE OF WORKS

PUBLISHED BY

H. K. LEWIS,

136 GOWER STREET, LONDON, W.C.

ESTABLISHED 1844.

Telegrams: PUBLICAVIT, LONDON. *Telephone:* 10721 CENTRAL.

A. C. ABBOTT, M.D.

Professor of Hygiene and Bacteriology, and Director of the Laboratory of Hygiene, University of Pennsylvania.

THE PRINCIPLES OF BACTERIOLOGY: A Practical Manual for Students and Physicians. Seventh Edition, with 100 Illustrations, 24 being coloured, post 8vo, 12s. 6d. *nett.* [*Just published.*

H. ALDERSMITH, M.B. LOND., F.R.C.S.

Medical Officer, Christ's Hospital, West Horsham.

RINGWORM AND ALOPECIA AREATA: Their Pathology, Diagnosis, and Treatment. Fourth Edition, enlarged, with new Illustrations, demy 8vo, 10s. 6d.

W. H. ALLCHIN, M.D. LOND., F.R.C.P.

University Scholar in Medicine; Member of the Senate and late Examiner in Medicine in the University; Life Governor of University College; Senior Physician to the Westminster Hospital.

AN ACCOUNT OF THE RECONSTRUCTION OF THE UNIversity of London. PART I.—From the Foundation of the University to the Appointment of the First Royal Commission, 1825 to 1888. Imperial 8vo, 2s. 6d. *net.*

IZETT ANDERSON, M.D. EDIN.

Extraordinary Member of the Royal Medical Society of Edinburgh; Honorary Member of the Institute of Jamaica.

YELLOW FEVER IN THE WEST INDIES. Crown 8vo, 3s. 6d.

JAMES ANDERSON, M.D., F.R.C.P.

Late Assistant Physician to the London Hospital, &c.

NOTES ON MEDICAL NURSING from the Lectures given to the Probationers at the London Hospital. Edited by E. F. LAMPORT, Associate of the Royal Sanitary Institute. With an Introductory Biographical Notice by the late SIR ANDREW CLARK, BART. Third Edition, with Glossary, crown 8vo, 2s. 6d.

March, 1906.

G. GRANVILLE BANTOCK, M.D., F.R.C.S. EDIN.

Surgeon to the Samaritan Free Hospital for Women and Children.

ON THE TREATMENT OF RUPTURE OF THE FEMALE Perineum Immediate and Remote. Second Edition, with Illustrations, 8vo, 3s. 6d.

FANCOURT BARNES, M.D., M.R.C.P.

Physician to the Chelsea Hospital for Women; Obstetric Physician to the Great Northern Hospital, &c

A GERMAN-ENGLISH DICTIONARY OF WORDS AND Terms used in Medicine and its Cognate Sciences. Square 12mo, Roxburgh binding, 9s.

Sir JAMES BARR, M.D.

Physician to the Northern Hospital, Liverpool; Medical Officer of Her Majesty's Prison, Kirkdale, &c.

THE TREATMENT OF TYPHOID FEVER, and reports of fifty-five consecutive cases with only one death. With Introduction by Sir W. T. GAIRDNER, M.D., LL.D., Professor of Medicine in the University of Glasgow. With Illustrations, demy 8vo, 6s.

ASHLEY W. BARRETT, M.B. LOND., M.R.C.S., L.D.S.E.

Consulting Dental Surgeon to the London Hospital, and late Lecturer on Dental Surgery in the Medical School; Examiner in Dental Surgery to the Royal College of Surgeons, England.

DENTAL SURGERY FOR MEDICAL PRACTITIONERS AND Students of Medicine. Fourth Edition, with Illustrations, crown 8vo, 3s. 6d.

[LEWIS'S PRACTICAL SERIES].

G. A. H. BARTON, M.D.

Anæsthetist to the North-West London Hospital, &c.

A GUIDE TO THE ADMINISTRATION OF ETHYL CHLOride. With Frontispiece, demy 8vo, 1s. 6d.

H. CHARLTON BASTIAN, M.A., M.D., F.R.S., F.R.C.P.

Emeritus Professor of the Principles and Practice of Medicine in University College, London; Consulting Physician to University College Hospital, &c.

I.

A TREATISE ON APHASIA AND OTHER SPEECH DEFECTS. With illustrations, medium 8vo, 15s.

II.

PARALYSES: CEREBRAL, BULBAR, AND SPINAL. A Manual of Diagnosis for Students and Practitioners. With numerous Illustrations, 8vo, 12s. 6d.

III.

VARIOUS FORMS OF HYSTERICAL OR FUNCTIONAL Paralysis. Demy 8vo, 7s. 6d.

W. BATESON, M.A., F.R.S.

MENDEL'S PRINCIPLES OF HEREDITY. A Defence, with a Translation of Mendel's original Paper on Hybridisation. Crown 8vo, 4s. *nett.*

W. M. BEAUMONT.

Surgeon to the Bath Eye Infirmary.

THE SHADOW-TEST IN THE DIAGNOSIS AND ESTImation of Ametropia. Post 8vo, 2s. 6d.

F. E. BEDDARD, M.A., F.R.S.

[See Cambridge Biological Series, page 5.

CHARLES E. BEEVOR, M.D. LOND., F.R.C.P.

Physician to the National Hospital for the Paralysed and Epileptic, the Great Northern Central Hospital, and the National Orthopædic Hospital.

DISEASES OF THE NERVOUS SYSTEM. A Handbook for Students and Practitioners. With Illustrations, crown 8vo, 10s. 6d.

[LEWIS'S PRACTICAL SERIES].

HORATIO R. BIGELOW, M.D.

Permanent Member of the American Medical Association, &c.

PLAIN TALKS ON ELECTRICITY AND BATTERIES, WITH Therapeutic Index. With Illustrations, crown 8vo, 4s. 6d.

JOHN FAIRBAIRN BINNIE, A.M., C.M. ABERD.

Professor of Surgery, Kansas City Medical College, &c.

MANUAL OF OPERATIVE SURGERY.

Second Edition, fully Illustrated, post 8vo, bound leather, gilt edges, 12s. 6d. net.

[*Just published.*

DRS. BOURNEVILLE AND BRICON.

MANUAL OF HYPODERMIC MEDICATION.

Translated from the Second Edition, and Edited, with Therapeutic Index of Diseases, by ANDREW S. CURRIE, M.D. Edin., &c. With Illustrations, crown 8vo, 3s. 6d.

RUBERT BOYCE, F.R.S., M.B., M.R.C.S.

Professor of Pathology in University College, Liverpool.

A TEXT-BOOK OF MORBID HISTOLOGY for Students and Practitioners. With 130 coloured Illustrations, royal 8vo, 31s. 6d.

A. BROCA, M.D.

Chirurgeon des Hôpitaux de Paris, &c.

AND

F. LUBET-BARBON, M.D.

Ancien interne des Hôpitaux de Paris.

MASTOID ABSCESSES AND THEIR TREATMENT. Translated and edited by HENRY J. CURTIS, B.S. and M.D. (Lond.), F.R.C.S. (Eng.), formerly Assistant to the Professor of Pathology, University College, London, &c. With coloured Illustrations, cr. 8vo, 6s.

MARY BULLAR & J. F. BULLAR, M.B. CANTAB., F.R.C.S.

RECEIPTS FOR FLUID FOODS. 16mo, 1s.

DUDLEY W. BUXTON, M.D., B.S., M.R.C.P.

Administrator of Anæsthetics and Lecturer in University College Hospital; Consulting Anæsthetist to the National Hospital for Paralysis and Epilepsy, Queen's Square, &c.

ANÆSTHETICS: THEIR USES AND ADMINISTRATION. Fourth Edition, with Illustrations, crown 8vo. [LEWIS'S PRACTICAL SERIES]. [*Nearly ready.*

JAMES CALVERT, B.A., B.SC., M.D. LOND.

Fellow of the Royal College of Physicians; Lecturer on Materia Medica, Pharmacology, and Therapeutics to St. Bartholomew's Hospital.

PRACTICAL PHARMACY AND PRESCRIBING FOR STUdents of Medicine. Being the Course in Use at St. Bartholomew's Hospital. Second Edition, crown 8vo, interleaved, 4s. 6d.

HARRY CAMPBELL, M.D., B.S. LOND., F.R.C.P.

Physician to the North-West London Hospital.

I.

THE CAUSATION OF DISEASE: An Exposition of the ultimate factors which induce it. Demy 8vo, 12s. 6d.

II.

FLUSHING AND MORBID BLUSHING: Their Pathology and Treatment. With plates and wood engravings, royal 8vo, 10s. 6d.

III.

DIFFERENCES IN THE NERVOUS ORGANISATION OF Man and Woman, Physiological and Pathological. Royal 8vo, 15s.

IV.

HEADACHE AND OTHER MORBID CEPHALIC SENSATIONS. Royal 8vo, 12s. 6d.

CAMBRIDGE BIOLOGICAL SERIES.

(*General Editor:* A. E. SHIPLEY, M.A., Fellow and Tutor of Christ's College).

THE VERTEBRATE SKELETON. By S. H. REYNOLDS, M.A. Trinity College, Cambridge; Lecturer and Demonstrator in Geology and Zoology at University College, Bristol. With numerous Illustrations, crown 8vo, 12s. 6d.

PRACTICAL MORBID ANATOMY. By H. D. ROLLESTON, M.D., F.R.C.P., Fellow of St. John's College, Cambridge; Assistant Physician and Lecturer on Pathology, St. George's Hospital, London; and A. A. KANTHACK, M.D., M.R.C.P., Lecturer on Pathology, St. Bartholomew's Hospital, London. Crown 8vo, 6s.

ZOOGEOGRAPHY. By F. E. BEDDARD, M.A., F.R.S. With Maps, crown 8vo, 6s.

PRACTICAL PHYSIOLOGY OF PLANTS. By F. DARWIN, M.A., F.R.S., and E. H. ACTON, M.A. Third Edition, with Illustrations, crown 8vo, 4s. 6d.

ELEMENTS OF BOTANY. By F. DARWIN, M.A., F.R.S. Second Edition, with numerous Illustrations, crown 8vo, 4s. 6d.

A MANUAL AND DICTIONARY OF THE FLOWERING PLANTS AND Ferns: Morphology, Natural History and Classification. Alphabetically arranged by J. C. WILLIS, M.A., Director of the Royal Botanic Gardens, Ceylon, &c. Second edition, 10s. 6d.

FOSSIL PLANTS, a Manual for Students of Botany and Geology. By A. C. SEWARD, M.A., F.R.S., St. John's College. In two volumes, demy 8vo. Vol. I., with Illustrations, 12s. [*Vol. II. just ready.*

PALÆONTOLOGY—INVERTEBRATE. By HENRY WOODS, M.A., F.G.S., University Lecturer in Palæo-zoology, Cambridge. Third Edition, revised and enlarged, with additional Illustrations, crown 8vo, 6s.

OUTLINES OF VERTEBRATE PALÆONTOLOGY FOR STUDENTS OF Zoology. By A. S. WOODWARD, M.A. With Illustrations, demy 8vo, 14s.

THE SOLUBLE FERMENTS AND FERMENTATION. By J. REYNOLDS GREEN, Sc.D., F.R.S., Professor of Botany to the Pharmaceutical Society of Great Britain, &c. Second Edition, 8vo, 12s.

ZOOLOGY, an Elementary Textbook. By A. E. SHIPLEY, M.A., Fellow and Tutor of Christ's College, Cambridge, and E. W. MACBRIDE, M.A. (Cantab.), D.Sc. (Lond.). With numerous Illustrations, 8vo, 10s. 6d. *net.*

GRASSES: a Handbook for use in the Field and Laboratory. By H. MARSHALL WARD, Sc.D., F.R.S., Crown 8vo, 6s.

LECTURES ON THE HISTORY OF PHYSIOLOGY DURING THE SIXteenth, Seventeenth, and Eighteenth Centuries. By Sir M. FOSTER, K.C.B., M.P., M.D., &c., Professor of Physiology in the University of Cambridge, &c. 8vo, 9s.

THE NATURAL HISTORY OF SOME COMMON ANIMALS. By O. H. LATTER, M.A., Science Master at Charterhouse School. Crown 8vo, 5s. *net.*

THE CLASSIFICATION OF FLOWERING PLANTS. By A. B. RENDLE, M.A. (Cantab.), D.Sc. (Lond.), Assistant in Botany, British Museum. Vol. I., Introduction, Gymnosperms, Monocotyledons. 8vo, 10s. 6d. *net.*

TREES. By H. M. WARD, Sc.D., F.R.S., Professor of Botany in the University of Cambridge, &c. Vol. I., Buds and Twigs. Vol. II., Leaves; Vol. III., Flowers. Crown 8vo, 4s. 6d. *net. each.*

MORPHOLOGY AND ANTHROPOLOGY. By W. L. H. DUCKWORTH, M.A., Fellow of Jesus College; University Lecturer in Physical Anthropology, &c. 8vo, 15s. *net.*

STUDIES FROM THE ANTHROPOLOGICAL LABORATORY. The Anatomy School, Cambridge. By the same Author. 8vo, 10s. *net.* [*Just published.*

THE ORIGIN AND INFLUENCE OF THE THOROUGHBRED HORSE. By W. RIDGEWAY, M.A., &c. 8vo, 12. 6d. *net.* [*Just published.*

THE MORPHOLOGY OF PLANTS. By J. C. WILLIS, M.A. [*In the press.*

CAMBRIDGE GEOLOGICAL SERIES.

HANDBOOK TO THE GEOLOGY OF CAMBRIDGESHIRE. For the use of Students. By F. R. COWPER REED, M.A., F.G.S., Assistant to the Woodwardian Professor of Geology. Crown 8vo, 7s. 6d.

PETROLOGY FOR STUDENTS: An Introduction to the Study of Rocks under the Microscope. By A. HARKER, M.A., F.G.S., Fellow of St. John's College; Demonstrator in Geology (Petrology) in the University of Cambridge. Third Edition, revised, cr. 8vo, 7s. 6d.

THE PRINCIPLES OF STRATIGRAPHICAL GEOLOGY. By J. E. MARR, M.A., F.R.S., Fellow and Lecturer of St. John's College, Cambridge, cr. 8vo, 6s.

A TREATISE ON CRYSTALLOGRAPHY. By W. J. LEWIS, M.A. Professor of Mineralogy in the University of Cambridge. 8vo, 14s. *net.*

CAMBRIDGE PHYSICAL SERIES.

(*General Editor:* R. T. GLAZEBROOK, M.A., F.R.S., Fellow of Trinity College; Assistant Director of the Cavendish Laboratory).

HEAT AND LIGHT. By R. T. GLAZEBROOK, M.A. Crown 8vo, 5s. The two Parts are also published separately. HEAT, 3s. LIGHT, 3s.

MECHANICS AND HYDROSTATICS. By the same Author. Crown 8vo, 8s. 6d. Also in separate Parts. Part I.—DYNAMICS, 4s. Part II.—STATICS, 3s. Part III.—HYDROSTATICS, 3s.

A TREATISE ON THE THEORY OF SOLUTION, INCLUDING PHENOMENA OF ELECTROLYSIS. By W. C. D. WHETHAM, M.A., F.R.S., Fellow of Trinity College. 8vo, 10s. *net.*

MECHANICS. By J. COX, M.A., F.R.S.C. 8vo, 9s. *net*

ELECTRICITY AND MAGNETISM. By R. T. GLAZEBROOK, M.A., F.R.S. Crown 8vo, 7s. 6d.

CONDUCTION OF ELECTRICITY THROUGH GASES. By J. J. THOMSON, D.Sc., LL.D., F.R.S., Fellow of Trinity College, Cambridge. 8vo, 16s.

RADIO-ACTIVITY. By E. RUTHERFORD, Trinity College, Cambridge, Professor of Physics at McGill University, Montreal. Second Edition, 8vo, 12s. 6d. *net.* [*Just published.*

TREATISE ON THE THEORY OF ALTERNATING CURRENTS. By A. RUSSELL, M.A., M.I.E.E., late Scholar and Assistant Lecturer, Gonville and Caius College, Cambridge. Vol I., 8vo, 12s. [*Just published.*

THE STUDY OF CHEMICAL COMPOSITION, an Account of its Method and Historical Development. By IDA FREUND, Staff Lecturer and Associate, Newnham College, 8vo, 18s. *net.* [*Just published.*

SOUND. By J. W. CAPSTICK, M.A., Fellow of Trinity College. [*In preparation.*

J. W. CAPSTICK, M.A.

[See Cambridge Physical Series, page 6.

ALFRED H. CARTER, M.D., M.SC. LOND.

Fellow of the Royal College of Physicians; Professor of Medicine, University of Birmingham; Senior Physician to the Queen's Hospital, Birmingham, &c.

ELEMENTS OF PRACTICAL MEDICINE.
Ninth Edition, crown 8vo. [*In the press.*

F. H. CHAMPNEYS, M.A., M.D. OXON., F.R.C.P.

Physician-Accoucheur and Lecturer on Obstetric Medicine at St. Bartholomew's Hospital: Examiner in Obstetric Medicine in the University of Oxford, &c.

I.

LECTURES ON PAINFUL MENSTRUATION. The Harveian Lectures, 1890. Roy. 8vo, 7s. 6d.

II.

EXPERIMENTAL RESEARCHES IN ARTIFICIAL RESPIRAtion in Stillborn Children, and Allied Subjects. Crown 8vo, 3s. 6d.

ALEXANDER COLLIE, M.D. ABERD., M.R.C.P. LOND.

Secretary of the Epidemiological Society for Germany and Russia, &c.

ON FEVERS: THEIR HISTORY, ETIOLOGY, DIAGNOSIS, Prognosis, and Treatment. Illustrated with Coloured Plates, crown 8vo, 8s. 6d. [LEWIS'S PRACTICAL SERIES].

E. TREACHER COLLINS, F.R.C.S.

Assistant Surgeon to the Royal London Ophthalmic Hospital, Moorfields; Hunterian Professor, Royal College of Surgeons, England, 1893-94.

RESEARCHES INTO THE ANATOMY AND PATHOLOGY OF the Eye. With 10 Plates and 28 Figures in the Text, demy 8vo, 6s.

WALTER S. COLMAN, M.D., F.R.C.P. LOND.

Assistant Physician to the National Hospital for the Paralysed and Epileptic, &c.

SECTION CUTTING AND STAINING: A Practical Introduction to Histological Methods for Students and Practitioners. Second Edition, with Illustrations, crown 8vo, 3s. 6d.

W. H. CORFIELD, M.A., M.D. OXON., F.R.C.P. LOND.

Consulting Sanitary Adviser to H. M. Office of Works; Hon. Sanitary Adviser to University College Hospital; Professor of Hygiene and Public Health in University College, London; Medical Officer of Health for St. George's, Hanover Square, &c.

I.

DWELLING HOUSES: their Sanitary Construction and Arrangements. Fourth Edition, with Illustrations, crown 8vo, 3s. 6d.

II.

DISEASE AND DEFECTIVE HOUSE SANITATION: Being Two Lectures delivered before the Harveian Society of London. With Illustrations, crown 8vo, 2s.

III.

THE ETIOLOGY OF TYPHOID FEVER AND ITS PREVENtion. Being the Milroy Lectures delivered at the Royal College of Physicians, 1902. Demy 8vo, 2s. 6d.

J. COX, M.A., F.R.S.C.

[See Cambridge Physical Series, page 6.

CHARLES CREIGHTON, M.A., M.D.

Formerly Demonstrator of Anatomy in the University of Cambridge.

I.

A HISTORY OF EPIDEMICS IN BRITAIN. Vol. I., From A.D. 664 to the Extinction of the Plague. Demy 8vo, 18s. Vol. II., From the Extinction of the Plague to the Present Time. Demy 8vo, 20s.

II.

ILLUSTRATIONS OF UNCONSCIOUS MEMORY IN DISEASE, including a Theory of Alteratives. Post 8vo, 6s.

H. RADCLIFFE-CROCKER, M.D. LOND., F.R.C.P.

Physician for Diseases of the Skin in University College Hospital, &c.

I.

DISEASES OF THE SKIN; THEIR DESCRIPTION, PATHOLOGY, Diagnosis, and Treatment. With special Reference to the Skin Eruptions of Children, and an Analysis of Fifteen Thousand Cases of Skin Disease. Third Edition, with 76 Plates and 112 Illustrations, 2 vols., med. 8vo, 30s. *nett.*

II.

THE CONDITIONS WHICH MODIFY THE CHARACTERS of Inflammations of the Skin, and their Influence on Treatment. Being the Lettsomian Lectures at the Medical Society of London, 1903. 8vo, 2s. 6d.

J. SADLER CURGENVEN, M.R.C.S., L.R.C.P.

THE CHILD'S DIET, crown 8vo, 1s. 6d. nett.

F. DARWIN, M.A., F.R.S.

[See Cambridge Biological Series, page 5.

ROBERT W. DOYNE, F.R.C.S.

Surgeon to the Oxford Eye Hospital; Ophthalmic Surgeon to St. John's Hospital, Cowley, and to the Bourton on Water Cottage Hospital.

NOTES ON THE MORE COMMON DISEASES OF THE EYE. With Test Types, crown 8vo, 2s.

W. L. H. DUCKWORTH, M.A.

[See Cambridge Biological Series, page 5.

PROF. A. DÜHRSSEN, M.D.

Professor in Midwifery and Gynæcology in the University of Berlin.

I.

A MANUAL OF GYNÆCOLOGICAL PRACTICE FOR STUDENTS and Practitioners. Second English, translated and edited from the Sixth German edition, by JOHN W. TAYLOR, F.R.C.S., Professor of Gynæcology, the University of Birmingham, and FREDERICK EDGE, M.D. LOND., M.R C.P., F.R.C.S., Surgeon to the Wolverhampton and District Hospital for Women. With 125 Illustrations, crown 8vo, 3s. 6d. *nett.*

II.

A MANUAL OF OBSTETRIC PRACTICE FOR STUDENTS and Practitioners. Translated and edited from the Sixth German Edition, by JOHN W. TAYLOR and FREDERICK EDGE. With Illustrations, crown 8vo, 3s. 6d. *nett.*

EDWARD J. EDWARDES, M.D. LOND.

Member of the Royal College of Physicians, London.

A CONCISE HISTORY OF SMALL-POX AND VACCINATION in Europe. Crown 8vo, 2s. 6d. *nett.*

W. ELDER, M.D., F.R.C.P. EDIN.

Physician to Leith Hospital.

APHASIA AND THE CEREBRAL SPEECH MECHANISM. With Illustrations, demy 8vo, 10s. 6d.

W. D'ESTE EMERY, M.D., B.SC. LOND.

Assistant Bacteriologist to the Laboratories of the Royal Colleges of Physicians and Surgeons, London; formerly Lecturer on Pathology and Bacteriology in the University of Birmingham, &c.

A HANDBOOK OF BACTERIOLOGICAL DIAGNOSIS FOR Practitioners (including Instructions for the Clinical Examination of the Blood). With 2 Coloured Plates and 33 Illustrations, crown 8vo, 5s. 6d.

[LEWIS'S PRACTICAL SERIES].

W. SOLTAU FENWICK, M.D., B.S. LOND., M.R.C.P.

Physician to Out-patients at the Evelina Hospital for Sick Children; Senior Physician to the London Temperance Hospital.

I.

DISORDERS OF DIGESTION IN INFANCY AND CHILDHOOD. With Illustrations, demy 8vo, 10s. 6d.

II.

THE DYSPEPSIA OF PHTHISIS: Its Varieties and Treatment, including a Description of Certain Forms of Dyspepsia associated with the Tubercular Diathesis. Demy 8vo, 6s.

G. H. FINK, M.R.C.S., L.S.A. LOND.

Major, Indian Medical Service (Retired).

CANCER, AND PRECANCEROUS CHANGES, their Origin and Treatment. 8vo, 5s.

W. H. RUSSELL FORSBROOK, M.D. LOND., M.R.C.S.

Consulting Medical Officer to the Government of the Cape of Good Hope; formerly Surgical Registrar to Westminster Hospital.

A DISSERTATION ON OSTEO-ARTHRITIS. Demy 8vo, 5s.

SIR M. FOSTER, K.C.B., M.D., ETC.

[See Cambridge Biological Series, page 5.

J. MILNER FOTHERGILL, M.D., M.R.C.P.

Late Physician to the City of London Hospital for Diseases of the Chest, Victoria Park, &c.

I.

INDIGESTION AND BILIOUSNESS. Second Edition, post 8vo, 7s. 6d.

II.

GOUT IN ITS PROTEAN ASPECTS. Post 8vo, 7s. 6d.

III.

THE TOWN DWELLER: His Needs and His Wants. With an Introduction by SIR B. W. RICHARDSON, M.D., LL.D., F.R.S. Post 8vo, 3s. 6d.

R. HINGSTON FOX, M.D. BRUX., M.R.C.P. LOND.

WILLIAM HUNTER: Anatomist, Physician, Obstetrician, (1718-1783). With notices of his friends CULLEN, SMELLIE, FOTHERGILL and BAILLIE. With seven Portrait-Prints, Chronological Chart of Life and Times, and View of Hunter's Birthplace, 8vo, 4s. 6d. *nett.*

IDA FREUND.

[See Cambridge Physical Series, page 6.

PROFESSOR DR. PAUL FÜRBRINGER.

Director of the Friedrichshain Hospital, Berlin, &c.

TEXT-BOOK OF DISEASES OF THE KIDNEYS AND Genito-Urinary Organs. Translated by W. H. GILBERT, M.D., Physician in Baden-Baden, &c. Vol. I., demy 8vo, 7s. 6d. Vol. II., demy 8vo, 10s. 6d.

SIR DOUGLAS GALTON.

Late Royal Engineers, K.C.B., Hon. D.C.L., LL.D., F.R.S., Assoc. Inst. C.E., M.I.Mech.E., F.S.A., F.G.S., F.L.S., F.C.S., F.R.G.S., &c.

HEALTHY HOSPITALS. Observations on some points connected with Hospital Construction. With Illustrations, 8vo, 10s. 6d.

JOHN HENRY GARRETT, M.D.

Licentiate in Sanitary Science and Diplomate in Public Health, Universities of Durham and Cambridge, &c.

THE ACTION OF WATER ON LEAD; being an inquiry into the Cause and Mode of the Action and its Prevention. Crown 8vo, 4s. 6d.

R. T. GLAZEBROOK, M.A., F.R.S.

[See Cambridge Physical Series, page 6.

E. W. GOODALL, M.D. LOND.

Medical Superintendent of the Eastern Hospital of the Metropolitan Asylums Board, formerly Medical Registrar to Guy's Hospital,

AND

J. W. WASHBOURN, C.M.G., M.D. LOND.

Fellow of the Royal College of Physicians; Physician to the London Fever Hospital; Assistant Physician to Guy's Hospital, and Lecturer in the Medical School.

A MANUAL OF INFECTIOUS DISEASES. Illustrated with Plates, Diagrams, and Charts, demy 8vo, 15s.

JAMES F. GOODHART, M.D. ABERD., F.R.C.P.

Physician to Guy's Hospital, and Consulting Physician to the Evelina Hospital for Sick Children.

ON COMMON NEUROSES: or the Neurotic Element in Disease and its Rational Treatment. Second Edition, crown 8vo, 3s. 6d.

GEORGE M. GOULD, A.M., M.D.

Ophthalmic Surgeon to the Philadelphia Hospital, &c.

I.

THE STUDENT'S MEDICAL DICTIONARY: including all the words and phrases generally used in Medicine, with their proper pronunciation and definitions, based on recent medical literature. Eleventh Edition, with elaborate Tables and many Illustrations, 8vo, 14s. *nett.*

II.

A POCKET MEDICAL DICTIONARY, Giving the Pronunciation and Definition of 30,000 of the Principal Words used in Medicine and the Collateral Sciences. Fourth Edition, bound limp, 32mo, 5s. *nett.*

WILLIAM GRAY, M.D., C.M. (EDIN.).

INFLUENZA, with Special Reference to some Peculiar Symptoms. 8vo, 3s. 6d.

J. REYNOLDS GREEN, SC.D., F.R.S.

[See Cambridge Biological Series, page 5.

DR. JOSEF GRUBER.

Professor of Otology in the University of Vienna, Etc.

A TEXT-BOOK OF THE DISEASES OF THE EAR. Translated from the Second German edition, and Edited, with additions, by Edward Law, M.D., C.M. Edin., M.R.C.S. Eng., Surgeon to the London Throat Hospital for Diseases of the Throat, Nose and Ear; and Coleman Jewell, M.B. Lond., M.R.C.S. Eng., late Surgeon and Pathologist to the London Throat Hospital. Second English Edition, with 165 Illustrations, and 70 coloured figures on 2 lithographic plates, royal 8vo, 28s.

F. DE HAVILLAND HALL, M.D., F.R.C.P. LOND.

Physician to the Westminster Hospital; President of the Laryngological Society of London,

AND

HERBERT TILLEY, M.D., B.S. LOND., F.R.C.S. ENG.

Surgeon to the Throat Hospital, Golden Square; Lecturer on Diseases of the Nose and Throat, London Post-Graduate College and Polyclinic.

DISEASES OF THE NOSE AND THROAT. Second edition, thoroughly revised, with 2 coloured Plates and 80 Illustrations, crown 8vo, 10s. 6d.
[Lewis's Practical Series].

H. J. HANSEN.

AND

W. SORENSEN.

Fellow Royal Danish Academy, Copenhagen.

ON TWO ORDERS OF ARACHNIDA OPILIONES. Especially the Sub-order, Cyphophthalmi and Ricinulei, namely the Cryptostemmatoidae. With 9 plates, 4to, 15s. *nett.* [*Just published.*

A. HARKER, M.A., F.G.S.

[See Cambridge Geological Series, page 6.

VINCENT DORMER HARRIS, M.D. LOND., F.R.C.P.

Physician to the City of London Hospital for Diseases of the Chest, Victoria Park; Examining Physician to the Royal National Hospital for Consumption and Diseases of the Chest, Ventnor, &c.,

AND

EDWIN CLIFFORD BEALE, M.A., M.B. CANTAB., F.R.C.P.

Physician to the City of London Hospital for Diseases of the Chest, Victoria Park, and to the Great Northern Central Hospital, &c.

THE TREATMENT OF PULMONARY CONSUMPTION. A Practical Manual. Crown 8vo, 10s. 6d. [Lewis's Practical Series].

Drs. HARVEY and DAVIDSON'S

SYLLABUS OF MATERIA MEDICA. Revised in accordance with the "British Pharmacopœia," 1898, by William Martindale, F.L.S., F.C.S., Member of Council of Pharmaceutical Society, and late Examiner; Joint Author of "The Extra Pharmacopœia." Tenth Edition, foolscap 16mo, 1s. *nett.*

W. S. HEDLEY, M.D.

Medical Officer in charge of the Electro-Therapeutic Department of the London Hospital.

I.

THE HYDRO-ELECTRIC METHODS IN MEDICINE. Second Edition, with Illustrations, demy 8vo, 4s. 6d.

II.

CURRENT FROM THE MAIN: The Medical Employment of Electric Lighting Currents. With Illustrations, demy 8vo, 2s. 6d.

III.

PRACTICAL MUSCLE-TESTING; AND, THE TREATMENT of Muscular Atrophies. With Illustrations, demy 8vo, 3s. 6d.

H. HELBING, F.C.S.

MODERN MATERIA MEDICA: For Medical Men, Pharmacists, and Students. Fourth Edition, 8vo, 8s. *nett.*

HERBERT T. HERRING, M.B., B.S. (DURH.), M.R.C.S.

THE STERILISATION OF URETHRAL INSTRUMENTS, and their Use in some Urinary Complaints. With Illustrations, demy 8vo, 5s.

C. HIGGENS, F.R.C.S.

Ophthalmic Surgeon to Guy's Hospital; Lecturer on Ophthalmology at Guy's Hospital Medical School.

A MANUAL OF OPHTHALMIC PRACTICE. Second Edition, revised and edited by A. W. Ormond, F.R.C.S.E., Assistant Surgeon, Royal Eye Hospital, Southwark, &c. With 66 Illustrations, crown 8vo, 7s. 6d. [Lewis's Practical Series].

BERKELEY HILL, M.B. LOND., F.R.C.S.

Professor of Clinical Surgery in University College; Surgeon to University College Hospital and to the Lock Hospital;

AND

ARTHUR COOPER, L.R.C.P., M.R.C.S.

Surgeon to the Westminster General Dispensary.

SYPHILIS AND LOCAL CONTAGIOUS DISORDERS. Second Edition, entirely re-written, royal 8vo, 18s.

JAMES HINSHELWOOD, M.A., M.D., F.F.P.S. GLAS.

Surgeon to the Glasgow Eye Infirmary.

LETTER-, WORD- AND MIND-BLINDNESS. Crown 8vo, 3s.

H. LEWIS JONES, M.A., M.D., F.R.C.P.

Medical Officer in charge of the Electrical Department in St. Bartholomew's Hospital; President of the British Electro-Therapeutic Society, &c.

MEDICAL ELECTRICITY. A Practical Handbook for Students and Practitioners. Fourth Edition, thoroughly revised and enlarged, with 12 plates and 168 Illustrations, demy 8vo, 12s. 6d. *nett.*
[LEWIS'S PRACTICAL SERIES].

L. VERNON JONES, M.D.

GONORRHŒAL ARTHRITIS, its Pathology, Symptoms, and Treatment. With Illustrations, crown 8vo, 2s. 6d.

T. N. KELYNACK, M.D.

Pathologist to the Manchester Royal Infirmary; Demonstrator and Lecturer on Pathology in the Owens College.

A CONTRIBUTION TO THE PATHOLOGY OF THE VERmiform Appendix. With Illustrations, large 8vo, 10s. 6d.

HENRY R. KENWOOD, M.B., D.P.H., F.C.S.

Professor of Hygiene and Public Health at University College, London, and Medical Officer of Health and Public Analyst for Stoke Newington and Finchley.

PUBLIC HEALTH LABORATORY WORK. The part on Public Health Bacteriological Work contributed by W. G. SAVAGE, M.D., B.Sc., D.P.H., Medical Officer of Health, Colchester, formerly Assistant to the Professor of Pathology, with Charge of the Bacteriological Department, University College, London, &c. Third Edition, with Illustrations, cr. 8vo, 10s. 6d.
[LEWIS'S PRACTICAL SERIES].

NORMAN KERR, M.D., F.L.S.

President of the Society for the Study of Inebriety; Consulting Physician, Dalrymple Home for Inebriates, etc.

INEBRIETY OR NARCOMANIA: its Etiology, Pathology, Treatment, and Jurisprudence. Third Edition, 8vo, 7s. 6d. *nett.*

DR. PHILALETHES KUHN.

Staff Surgeon to the Imperial Troops of the South West African Protectorate.

INOCULATION AGAINST MALARIA.
Translated by H. A. NESBIT, M.A., with a Table of Curves. 8vo, 2s. *nett.*

F. CHARLES LARKIN, F.R.C.S. ENG.

Surgeon to the Stanley Hospital; late Assistant Lecturer in Physiology in University College, Liverpool,

AND

RANDLE LEIGH, M.B., B.SC. LOND.

Senior Demonstrator of Physiology in University College, Liverpool.

OUTLINES OF PRACTICAL PHYSIOLOGICAL CHEMISTRY.
Second Edition, with Illustrations, crown 8vo, paper 2s. 6d. *nett*, or cloth 3s. *nett.*

O. H. LATTER, M.A.

[See Cambridge Biological Series, page 5.

J. WICKHAM LEGG, F.R.C.P.

Formerly Assistant Physician to Saint Bartholomew's Hospital, and Lecturer on Pathological Anatomy in the Medical School.

I.

ON THE BILE, JAUNDICE, AND BILIOUS DISEASES.
With Illustrations in chromo-lithography, roy. 8vo, 25s.

II.

A GUIDE TO THE EXAMINATION OF THE URINE.
Seventh Edition, edited and revised, by H. LEWIS JONES, M.D., M.A., F.R.C.P., Medical Officer in charge of the Electrical Department in St. Bartholomew's Hospital. With Illustrations, fcap. 8vo, 3s. 6d.

ARTHUR H. N. LEWERS, M.D. LOND., F.R.C.P. LOND.

Senior Obstetric Physician to the London Hospital, and Lecturer on Midwifery, London Hospital Medical School; Examiner in Midwifery and Diseases of Women at the Conjoint Board of the Royal College of Physicians of London, and of the Royal College of Surgeons of England; late Examiner in Obstetric Medicine to the University of London, &c.

I.

CANCER OF THE UTERUS: A Clinical Monograph on its Diagnosis and Treatment. With the After Results in Seventy-Three Cases Treated by Radical Operation. With 3 coloured Plates and 51 original Illustrations, 8vo, 10s. 6d. *nett.*

II.

A PRACTICAL TEXTBOOK OF THE DISEASES OF WOMEN.
Sixth Edition, with 166 Illustrations and 4 coloured Plates, crown 8vo, 10s. 6d.
[LEWIS'S PRACTICAL SERIES].

PROF. W. J. LEWIS, M.A.

[See Cambridge Geological Series, page 6.

ROBERT LINDSAY, A.M., M.B., F.R.C.S.E.

Retired Surgeon, Army Medical Department.

AN ESSAY ON MALARIA AND ITS CONSEQUENCES.
Crown 8vo, 4s.

WILLIAM A. M'KEOWN, M.D., M.CH.

Surgeon to the Ulster Eye, Ear, and Throat Hospital, Belfast; Member of the Senate of the Royal University of Ireland; Lecturer on Ophthalmology and Otology, Queen's College, Belfast.

A TREATISE ON "UNRIPE" CATARACT, and its Successful Treatment by Operation, with Tables comprising 151 Cases. With Illustrations. royal 8vo, 12s. 6d. *nett.*

DONALD J. MACKINTOSH, M.B., M.V.O.

Medical Superintendent, Western Infirmary, Glasgow.

SKIAGRAPHIC ATLAS OF FRACTURES AND DISLOCATIONS, with Notes on Treatment, for the use of Students. With 80 plates, demy 4to, 12s. 6d. *nett.*

J. M. H. MACLEOD, M.A., M.D., M.R.C.P.

Assistant Physician for Diseases of the Skin, Charing Cross Hospital; Physician for Diseases of the Skin, Victoria Hospital for Children; Lecturer on Skin Diseases, London School of Tropical Medicine.

PRACTICAL HANDBOOK OF THE PATHOLOGY OF THE Skin. An Introduction to the Histology, Pathology, and Bacteriology of the Skin, with Special Reference to Technique. With 40 Plates, 8 being in Colours, from original Drawings, demy 8vo, 15s. *nett.*

J. E. MARR, M.A.

[See Cambridge Geological Series, page 6.

JEFFERY A. MARSTON, M.D., C.B., F.R.C.S., M.R.C.P. LOND.

Surgeon General Medical Staff (Retired).

NOTES ON TYPHOID FEVER: Tropical Life and its Sequelæ. Crown 8vo, 3s. 6d.

WILLIAM MARTINDALE, F.L.S., F.C.S.

Late President and Examiner of the Pharmaceutical Society,

AND

W. WYNN WESTCOTT, M.B. LOND., D.P.H.

H.M.'s Coroner for North-East London.

THE EXTRA PHARMACOPŒIA. Eleventh Edition, revised by W. HARRISON MARTINDALE, PH.D., F.C.S., and W. WYNN WESTCOTT, M.B., &c., limp roan, med. 24mo, 9s. 6d. *nett.*

W. HARRISON MARTINDALE, PH.D., F.C.S.

A SYNOPSIS OF THE PRINCIPAL CHANGES IN THE United States Pharmacopœia, effected by the eighth decennial revision, 1900, Official from Sept. 1, 1905, compared with that of 1890, and the British Pharmacopœia 1898, post 8vo, 2s. nett.

[*Presented with each copy of the* "Extra Pharmacopœia."]

WILLIAM MARTINDALE, F.C.S.

Late Examiner of the Pharmaceutical Society, &c.

I.

COCA, AND COCAINE: their History, Medical and Economic Uses, and Medicinal Preparations. Fourth Edition, fcap. 8vo, 2s.

II.

ANALYSES OF TWELVE THOUSAND PRESCRIPTIONS: being Statistics of the Frequency of Use therein of all Official and Unofficial Preparations. Fcap. 4to, 2s. 6d. *nett.*

MATERIA MEDICA LABELS.

Adapted for Public and Private Collections. Compiled from the British Pharmacopœia of 1898 and other sources. The Labels are arranged in Two Divisions:—

Division I.—Comprises Chemical Materia Medica, including Alcohols, Alkaloids, Sugars, and Neutral Bodies.

Division II.—Comprises, with few exceptions, Substances of Organized Structure, obtained from the Vegetable and Animal Kingdoms.

On gummed paper, 12s. 6d. *nett.*

⁂ Specimens of the Labels, of which there are about 500, will be sent on application

C. W. MANSELL MOULLIN, M.D. OXON., F.R.C.S.

Surgeon to and Lecturer on Surgery at the London Hospital; Examiner in Surgery at the University of Oxford, &c.

I.

INFLAMMATION OF THE BLADDER AND URINARY Fever. 8vo, 5s.

II.

ENLARGEMENT OF THE PROSTATE: its Treatment and Radical Cure. Third edition, with plates, 8vo, 6s. [*Just published.*

III.

SPRAINS; THEIR CONSEQUENCES AND TREATMENT. Second Edition, crown 8vo, 4s. 6d.

GEORGE R. MURRAY, M.A., M.D. CAMB., F.R.C.P.

Heath Professor of Comparative Pathology in the University of Durham; Physician to the Royal Infirmary, Newcastle.

DISEASES OF THE THYROID GLAND. Part I., MYXŒDEMA AND CRETINISM. With 25 Illustrations, demy 8vo, 7s. 6d.

WILLIAM MURRAY, M.D., F.R.C.P. LOND.

I.

ROUGH NOTES ON REMEDIES. Fourth Edition, with additional Chapter on Rothbury as a Health Resort. Crown 8vo, 4s. *nett.*

II.

ILLUSTRATIONS OF THE INDUCTIVE METHOD IN MEDICINE. Crown 8vo, 3s. 6d.

WILLIAM MURRELL, M.D., F.R.C.P.

Physician to, and Lecturer on Clinical Medicine and Joint Lecturer on the Principles and Practice of Medicine at, the Westminster Hospital; Examiner in Materia Medica in the University of Glasgow.

WHAT TO DO IN CASES OF POISONING. Ninth Edition, royal 32mo, 3s. 6d.

GEORGE OLIVER, M.D. LOND., F.R.C.P. LOND.

I.

BLOOD-PRESSURE AND TISSUE-LYMPH CIRCULATION: The Oliver-Sharpey Lectures, 1904, with addenda. [*Preparing.*

II.

A CONTRIBUTION TO THE STUDY OF THE BLOOD AND BLOOD-PRESSURE; founded on Portions of the Croonian Lectures delivered before the Royal College of Physicians, London, 1896, with Considerable Extensions. With Illustrations, demy 8vo, 7s. 6d.

III.

HARROGATE AND ITS WATERS: Notes on the Climate of Harrogate, and on the Chemistry of the Mineral Spring. With Map of the Wells, crown 8vo, 2s. 6d.

IV.

ON BEDSIDE URINE TESTING: a Clinical Guide to the Observation of Urine in the course of Work. Fourth Edition, fcap. 8vo, 3s. 6d.

DR. A. ONODI.

Lecturer on Rhino-Laryngology in the University of Budapest.

THE ANATOMY OF THE NASAL CAVITY, AND ITS ACCESsory Sinuses. An Atlas for Practitioners and Students. Translated by ST CLAIR THOMSON, M.D. LOND., F.R.C.S. ENG., M.R.C.P. LOND. With plates, small 4to, 6s. *nett.*

SAML. OSBORN, F.R.C.S.

Knight of Grace of the Order of St. John of Jerusalem; Lecturer and Examiner to the St. John Ambulance Association; Surgeon to the Hospital for Women, Soho Square, &c.

I.

AMBULANCE LECTURES: FIRST AID TO THE INJURED. Fourth Edition, with Illustrations, fcap. 8vo, 2s.

II.

AMBULANCE LECTURES: HOME NURSING AND HYgiene. Third Edition, with Illustrations, fcap. 8vo, 2s.

WILLIAM OSLER, M.D., F.R.C.P. LOND., F.R.S.

Regius Professor of Medicine, University of Oxford; President of the Association of American Physicians; late Professor of Medicine, Johns Hopkins University, and Physician-in-Chief Johns Hopkins Hospital, Baltimore.

I.

ÆQUANIMITAS. With other Addresses to Medical Students, Nurses, and Practitioners of Medicine, Third impression, post 8vo, 7s. 6d.

II.

ON CHOREA AND CHOREIFORM AFFECTIONS. Large 8vo, 5s.

III.

THE CEREBRAL PALSIES OF CHILDREN. A Clinical Study from the Infirmary for Nervous Diseases, Philadelphia. Demy 8vo, 5s.

WILLIAM OSLER, M.D., F.R.S., F.R.C.P. LOND.

AND

THOMAS McCRAE, M.B. TOR., L.R.C.P. LOND.

Of the Johns Hopkins Hospital, Baltimore.

CANCER OF THE STOMACH; a Clinical Study. With Illustrations, med. 8vo, 6s.

KURRE W. OSTROM.

Instructor in Massage and Swedish Movements in the Philadelphia Polyclinic and College for Graduates in Medicine.

MASSAGE AND THE ORIGINAL SWEDISH MOVEMENTS; their application to various diseases of the body. Sixth Edition, with 115 Illustrations, crown 8vo, 3s. 6d. *nett.* [*Just published.*

CHARLES A. PARKER. F.R.C.S. EDIN.

Assistant Surgeon to the Hospital for Diseases of the Throat, Golden Square, London.

POST-NASAL GROWTHS. Demy 8vo, 4s. 6d.

ROBERT W. PARKER.

Senior Surgeon to the East London Hospital for Children; Surgeon to the German Hospital.

DIPHTHERIA: ITS NATURE AND TREATMENT, WITH Special Reference to the Operation, After-Treatment, and Complications of Tracheotomy. Third Edition, with Illustrations, 8vo, 6s.

LOUIS PARKES, M.D., D.P.H. LOND. UNIV.

Fellow of the Royal Sanitary Institute; Lecturer on Public Health at St. George's Hospital Medical School; Medical Officer of Health for Chelsea,

AND

HENRY R. KENWOOD, M.B., D.P.H., F.C.S.

Fellow of the Royal Sanitary Institute and Member of the Board of Examiners; Professor of Hygiene and Public Health at University College, London, &c.

HYGIENE AND PUBLIC HEALTH. Second edit., with 88 Illustrations, crown 8vo, 12s. [LEWIS'S PRACTICAL SERIES].

LOUIS PARKES, M.D., D.P.H. LOND. UNIV.

INFECTIOUS DISEASES, NOTIFICATION AND PREVENTION. Fcap. 8vo, cloth, 2s. 6d.

LESLIE PHILLIPS, M.D.

Surgeon to the Birmingham and Midland Skin and Lock Hospital.

MEDICATED BATHS IN THE TREATMENT OF SKIN DISEASES. Crown 8vo, 4s. 6d.

J. E. PLATT, M.S. LOND., F.R.C.S.

Honorary Surgeon to the Hulme Dispensary; Surgical Officer to the Cancer Hospital, Manchester, &c.

A CONTRIBUTION TO THE SURGERY OF FRACTURES and Dislocations of the Upper Extremity, based upon an analysis of about 700 Consecutive Cases observed at the Manchester Royal Infirmary. With Illustrations, royal 8vo, 10s.

G. V. POORE, M.D., F.R.C.P.

Professor of Medical Jurisprudence, University College; Assistant Physician to, and Physician in charge of the Throat Department of, University College Hospital.

LECTURES ON THE PHYSICAL EXAMINATION OF THE Mouth and Throat. With an Appendix of Cases. 8vo, 3s. 6d.

SIR RICHARD DOUGLAS POWELL, Bart., M.D. LOND., F.R.C.P.

Physician Extra-ordinary to His Majesty the King; Physician to the Middlesex Hospital; Consulting Physician to the Brompton Hospital, &c.

THE LUMLEIAN LECTURES ON THE PRINCIPLES WHICH Govern Treatment in Diseases and Disorders of the Heart. With coloured Diagrams, demy 8vo, 6s.

BY THE SAME AUTHOR

DISEASES OF THE LUNGS AND PLEURÆ, INCLUDING Consumption. Fourth Edition, with coloured plates and wood engravings, 8vo, 18s.

TABLE OF PHYSICAL EXAMINATION OF THE LUNGS: with Note on International Nomenclature of Physical Signs (reprinted from SIR R. D. POWELL's "Diseases of the Lungs"). On one sheet, 6d.

D'ARCY POWER, M.A., M.B. OXON., F.R.C.S. ENG.

Surgeon to St. Bartholomew's Hospital; Senior Surgeon to the Victoria Hospital for Children, Chelsea; Examiner in the University of Durham; Member of the Conjoint Examining Board of the Royal College of Physicians (Lond.) and of Surgeons (Eng.).

THE SURGICAL DISEASES OF CHILDREN AND THEIR Treatment by Modern Methods. With Illustrations, crown 8vo, 10s. 6d.
[LEWIS'S PRACTICAL SERIES].

URBAN PRITCHARD, M.D. EDIN., F.R.C.S. ENG.

Professor of Aural Surgery at King's College, London; Aural Surgeon to King's College Hospital; Senior Surgeon to the Royal Ear Hospital.

HANDBOOK OF DISEASES OF THE EAR FOR THE USE of Students and Practitioners. Fourth Edition, with Illustrations, crown 8vo.
[LEWIS'S PRACTICAL SERIES].
[*In preparation.*

DR. THEODOR PUSCHMANN.

Public Professor in Ordinary at the University of Vienna.

A HISTORY OF MEDICAL EDUCATION FROM THE MOST Remote to the Most Recent Times. Translated and edited by EVAN H. HARE, M.A. OXON., F.R.C.S. ENG., L.S.A. Demy 8vo, 21s.

C. H. RALFE, M.A., M.D. CANTAB., F.R.C.P. LOND.

Assistant Physician to the London Hospital; Examiner in Medicine to the University of Durham, &c., &c.

A PRACTICAL TREATISE ON DISEASES OF THE KIDneys and Urinary Derangements. With Illustrations, crown 8vo, 10s. 6d.
[LEWIS'S PRACTICAL SERIES].

LOUIS BATHE RAWLING, M.B., B.C. (CANT.), F.R.C.S. (ENG.).

Assistant Surgeon, Senior Demonstrator of Anatomy, and Demonstrator of Practical Surgery, St. Bartholomew's Hospital; Assistant Surgeon to the German Hospital, Dalston; late Hunterian Professor, Royal College of Surgeons, England.

LANDMARKS AND SURFACE MARKINGS OF THE HUMAN Body. Second Edition, demy 8vo, 25 plates (3 in colour) 5s. nett. [*Just published.*

F. R. COWPER REED, M.A., F.G.S.

[See Cambridge Geological Series, page 6.

H. A. REEVES, F.R.C.S. EDIN.

Senior Assistant Surgeon and Teacher of Practical Surgery at the London Hospital; Surgeon to the Royal Orthopædic Hospital.

BODILY DEFORMITIES AND THEIR TREATMENT: A Handbook of Practical Orthopædics. With Illustrations, crown 8vo, 8s. 6d.
[LEWIS'S PRACTICAL SERIES].

A. B. RENDLE, M.A. (CANTAB.), B.SC. (LOND.).

[See Cambridge Biological Series, page 5.

SIDNEY H. REYNOLDS, M.A.

[See Cambridge Biological Series, page 5.

SAMUEL RIDEAL, D.SC. LOND., F.I.C., F.C.S.

Fellow of University College, London

I.

PRACTICAL ORGANIC CHEMISTRY; The Detection and Properties of some of the more important Organic Compounds. Second edition, 12mo, 2s. 6d.

II.

PRACTICAL CHEMISTRY FOR MEDICAL STUDENTS, required at the First Examination of the Conjoint Examining Board in England. Fcap 8vo, 2s.

J. JAMES RIDGE, M.D.

Medical Officer of Health, Enfield.

ALCOHOL AND PUBLIC HEALTH. Second Edition, crown 8vo, 2s.

W. RIDGEWAY, M.A., &c.

[See Cambridge Biological Series, page 5.

E. A. RIDSDALE.

Associate of the Royal School of Mines.

COSMIC EVOLUTION; being Speculations on the Origin of our Environment. Fcap. 8vo, 3s.

SYDNEY RINGER, M.D., F.R.S.

Holme Professor of Clinical Medicine in University College; Physician to University College Hospital,

AND

HARRINGTON SAINSBURY, M.D., F.R.C.P.

Physician to the Royal Free Hospital and the City of London Hospital for Diseases of the Chest, Victoria Park.

A HANDBOOK OF THERAPEUTICS. Thirteenth Edition, thoroughly revised, 8vo, 16s.

SYDNEY RINGER, M.D., F.R.S.

ON THE TEMPERATURE OF THE BODY AS A MEANS of Diagnosis and Prognosis in Phthisis. Second Edition, small 8vo, 2s. 6d.

FREDERICK T. ROBERTS, M.D., B.SC., F.R.C.P.

Fellow of University College; Emeritus Professor of Medicine and Clinical Medicine at University College; Consulting Physician to University College Hospital; Consulting Physician to Brompton Consumption Hospital, &c.

THE THEORY AND PRACTICE OF MEDICINE. Tenth Edition, with Illustrations, 2 vols., large 8vo, 26s. *nett.* [*Just published.*

R. LAWTON ROBERTS, M.D. LOND., D.P.H. CAMB., M.R.C.S. ENG.

Honorary Life Member of, and Lecturer and Examiner to, the St. John Ambulance Association; J.P. for County of Denbigh.

I.

ILLUSTRATED LECTURES ON AMBULANCE WORK. Fifth Edition, copiously Illustrated, crown 8vo, 2s. 6d.

II.

ILLUSTRATED LECTURES ON NURSING AND HYGIENE. Third Edition, with Illustrations, crown 8vo, 2s. 6d.

H. D. ROLLESTON, M.D., F.R.C.P.

[See Cambridge Biological Series, page 5.

WILLIAM ROSE, M.B., B.S. LOND., F.R.C.S.

Professor of Surgery in King's College, London, and Surgeon to King's College Hospital.

HARELIP AND CLEFT PALATE. With Illustrations, demy 8vo, 6s.

BERNARD ROTH, F.R.C.S.

Orthopædic Surgeon to the Royal Alexandra Children's Hospital, Brighton, &c.

THE TREATMENT OF LATERAL CURVATURE OF THE Spine: with Appendix giving an Analysis of 1000 Consecutive Cases treated by "Posture and Exercise" exclusively (without Mechanical Support). Second edition, with Photographic and other Illustrations, royal 8vo, 10s. 6d.

A. RUSSELL, M.A., M.I.E.E.

[See Cambridge Physical Series, page 6.

PROF. E. RUTHERFORD.

[See Cambridge Physical Series, page 6.

JOHN SAVORY.

Member of the Society of Apothecaries, London.

A COMPENDIUM OF DOMESTIC MEDICINE AND COMpanion to the Medicine Chest: Intended as a source of easy reference for Clergymen, Master Mariners, and Travellers; and for Families resident at a distance from professional assistance. Tenth Edition, sm. 8vo, 5s.

A. C. SEWARD, M.A., F.G.S.

[See Cambridge Biological Series, page 5.

A. E. SHIPLEY, M.A.,
AND
E. W. MACBRIDE, M.A.

[See Cambridge Biological Series, page 5.

G. E. SHUTTLEWORTH, B.A., M.D.

Formerly Medical Examiner of Defective Children, School Board for London; late Medical Superintendent, Royal Albert Asylum for Idiots and Imbeciles of the Northern Counties, Lancaster, &c.

MENTALLY-DEFICIENT CHILDREN: THEIR TREATMENT and Training. Second edition, with Illustrations, crown 8vo, 5s. *nett.*

DAVID SIME, M.D.

RABIES: Its Place Amongst Germ Diseases, and its Origin in the Animal Kingdom. Royal 8vo, 10s. 6d. *nett.*

FRANCIS W. SMITH, M.B., B.S.

THE SALINE WATERS OF LEAMINGTON. Second Edition, with Illustrations, crown 8vo, 1s. *nett.*

E. HUGH SNELL, M.D., B.SC. LOND.

Diplomate in Public Health of the University of Cambridge; Medical Officer of Health to the City of Coventry; late London County Council Medical Officer to the Blackwall Tunnel.

COMPRESSED AIR ILLNESS, OR SO-CALLED CAISSON Disease. With Illustrations, demy 8vo, 10s. 6d.

JOHN KENT SPENDER, M.D. LOND.

Physician to the Royal Mineral Water Hospital, Bath.

THE EARLY SYMPTOMS AND THE EARLY TREATMENT of OSTEO-ARTHRITIS, commonly called Rheumatoid Arthritis, with special reference to the Bath Thermal Waters. Sm. 8vo, 2s. 6d.

LOUIS STARR, M.D.

Physician to the Children's Hospital, Philadelphia, &c.

HYGIENE OF THE NURSERY. Including the General Regimen and Feeding of Infants and Children; Massage, and the Domestic Management of the Ordinary Emergencies of Early Life. Seventh Edition, with Illustrations crown 8vo, 3s. 6d. [*Just ready.*

JOHN LINDSAY STEVEN, M.D.

Assistant Physician and Pathologist, Glasgow Royal Infirmary; Physician for Out-patients, Royal Hospital for Sick Children, Glasgow, &c.

THE PATHOLOGY OF MEDIASTINAL TUMOURS. With special reference to Diagnosis. With Plates, 8vo, 4s. 6d.

JUKES DE STYRAP, M.R.C.P.I., ETC.

Physician-Extraordinary, late Physician in Ordinary, to the Salop Infirmary; Consulting Physician to the South Salop and Montgomeryshire Infirmaries, etc.

I.

THE YOUNG PRACTITIONER: WITH PRACTICAL HINTS and Instructive Suggestions, as Subsidiary Aids, for his Guidance on Entering into Private Practice. Demy 8vo, 7s. 6d. *nett.*

II.

A CODE OF MEDICAL ETHICS: WITH GENERAL AND Special Rules for the Guidance of the Faculty and the Public in the Complex Relations of Professional Life. Fourth Edition, demy 8vo, 3s. 6d. *nett.*

III.

MEDICO-CHIRURGICAL TARIFFS. Fifth Edition, revised and enlarged, fcap. 4to, 2s. *nett.*

IV.

THE YOUNG PRACTITIONER: HIS CODE AND TARIFF. Being the above three works in one volume. Demy 8vo, 10s. 6d. *nett.*

C. W. SUCKLING, M.D. LOND., M.R.C.P.

Professor of Materia Medica and Therapeutics at the Queen's College, Physician to the Queen's Hospital, Birmingham, etc.

I.

MOVABLE KIDNEY: A CAUSE OF INSANITY, HEADACHE, Neurasthenia, Insomnia, Mental Failure, and other Disorders of the Nervous System. A cause also of Dilatation of the Stomach. With Illustrations in Half-Tone, &c., demy 8vo, cloth, 10s. 6d. net.

II.

ON THE DIAGNOSIS OF DISEASES OF THE BRAIN Spinal Cord, and Nerves. With Illustrations, crown 8vo, 8s. 6d.

III.

ON THE TREATMENT OF DISEASES OF THE NERVOUS System. Crown 8vo, 7s. 6d.

J. BLAND-SUTTON, F.R.C.S.

Assistant Surgeon to the Middlesex Hospital; Examiner in Anatomy for the Fellowship to the Royal College of Surgeons, England.

LIGAMENTS: THEIR NATURE AND MORPHOLOGY. Third Edition, with numerous Illustrations, post 8vo, 4s. 6d.

HENRY R. SWANZY, A.M., M.B., F.R.C.S.I.

Surgeon to the Royal Victoria Eye and Ear Hospital, and Ophthalmic Surgeon to the Adelaide Hospital, Dublin; Ex-President of the Ophthalmological Society of the United Kingdom.

A HANDBOOK OF THE DISEASES OF THE EYE AND their Treatment. Eighth Edition, illustrated with 168 wood-engravings, colour tests, &c., small 8vo, 12s. 6d.

ALBERT TAYLOR.

Member Royal Sanitary Institute; late Demonstrator to the Students of the Sanitary Institute; Sanitary Inspector, City of Westminster; Late Chief Sanitary Inspector to the Vestry of St. George, Hanover Square, &c.

THE SANITARY INSPECTOR'S HANDBOOK. Fourth Edition, with Illustrations, crown 8vo, 6s.

H. COUPLAND TAYLOR, M.D.

Fellow of the Royal Meteorological Society.

WANDERINGS IN SEARCH OF HEALTH, OR MEDICAL and Meteorological Notes on Various Foreign Health Resorts. With Illustrations, crown 8vo, 6s.

JOHN W. TAYLOR, F.R.C.S. ENG.

Professor of Gynæcology in the University of Birmingham; Senior In-patient Surgeon to the Birmingham and Midland Hospital for Women; Consulting Surgeon to the Wolverhampton Hospital for Women; Consulting Gynæcological Surgeon to the Birmingham Skin and Lock Hospital, &c.

EXTRA-UTERINE PREGNANCY. A Clinical and Operative Study. With Illustrations, demy 8vo, 7s. 6d.

J. J. THOMSON, D.SC., LL.D., F.R.S.

[See Cambridge Physical Series, page 6.

HERBERT TILLEY, M.D., B.S. LOND., F.R.C.S. ENG.

Surgeon to the Throat Hospital, Golden Square; Lecturer on Diseases of the Nose and Throat, London Post-Graduate College and Polyclinic.

PURULENT NASAL DISCHARGES, their Diagnosis and Treatment. Second Edition, with Illustrations, crown 8vo, 4s. *nett.*

M. TUCHMANN, M.R.C.S. ENG., M.D. WURZBURG.

Formerly Surgeon to Out-Patients, German Hospital, Dalston.

THE EXPLORATION OF THE URETHRA AND BLADDER. With 26 Illustrations, demy 8vo, 5s.

A. DUNBAR WALKER, M.D., C.M.

THE PARENT'S MEDICAL NOTE BOOK. Oblong post 8vo, cloth, 1s. 6d.

E. W. AINLEY WALKER, M.A., D.M. (OXON.).

Fellow and Praelector of University College, Oxford; Late Gordon Lecturer in Experimental Pathology at Guy's Hospital; formerly Radcliffe Travelling Fellow in the University of Oxford, &c.

THE GENERAL PATHOLOGY OF INFLAMMATION, INfection, and Fever, being the Gordon Lectures for 1902. Crown 8vo, 4s. 6d. *nett.*

H. MARSHALL WARD, SC.D., F.R.S.

[See Cambridge Biological Series, page 5.

W. WYNN WESTCOTT, M.B.

H.M.'s Coroner for North-East London.

SUICIDE; its History, Literature, Jurisprudence, and Prevention. Crown 8vo, 6s.

FRANK J. WETHERED, M.D.

Medical Registrar to the Middlesex Hospital, and Demonstrator of Practical Medicine in the Middlesex Hospital Medical School; late Assistant Physician to the City of London Chest Hospital, Victoria Park.

MEDICAL MICROSCOPY. A Guide to the Use of the Microscope in Medical Practice. With Illustrations, crown 8vo, 9s.

[LEWIS'S PRACTICAL SERIES].

W. C. D. WHETHAM, M.A.

[See Cambridge Physical Series, page 6.

L. R. WILBERFORCE, M.A.
AND
T. C. FITZPATRICK, M.A.

Demonstrators at the Cavendish Laboratory, Cambridge.

A LABORATORY NOTE-BOOK OF ELEMENTARY PRACtical Physics. I. MECHANICS AND HYDROSTATICS. II. HEAT AND OPTICS. III. MAGNETISM AND ELECTRICITY. Quarto, paper covers, 1s. *each.*

SIR JOHN WILLIAMS, BART., M.D., F.R.C.P.

Consulting Physician to University College Hospital; Physician Accoucheur to H.R.H. Princess Beatrice, &c.

CANCER OF THE UTERUS: Being the Harveian Lectures for 1886. Illustrated with Lithographic Plates, royal 8vo, 10s. 6d.

W. WILLIAMS, M.A., M.D., D.P.H. (OXON.).

Medical Officer of Health to the Glamorgan County Council; Lecturer in Public Health to the University College of South Wales and Monmouthshire, Cardiff; Examiner in State Medicine to the University of London, &c.

DEATHS IN CHILDBED: A Preventable Mortality, being the Milroy Lectures for 1904. Demy 8vo, 2s. 6d. *nett.*

J. C. WILLIS, M.A.

[See Cambridge Biological Series, page 5.

E. T. WILSON, M.B. OXON., F.R.C.P. LOND.

Physician to the Cheltenham General Hospital; Associate Metropolitan Association of Medical Officers of Health.

DISINFECTANTS AND ANTISEPTICS: HOW TO USE THEM. 40th Thousand. In Packets of one doz. price 1s., by post 1s. 1d.

[*Thoroughly revised.*

BERTRAM C. A. WINDLE, F.R.S., SC.D., M.D., M.A. DUBL.

President, Queen's College, Cork: Examiner in Anatomy, Royal College of Physicians, London; formerly Professor of Anatomy in the University of Birmingham; sometime Examiner in Anatomy in the Universities of Cambridge, Aberdeen, and Durham.

A HANDBOOK OF SURFACE ANATOMY AND LANDMARKS. Third Edition, Illustrated with plain and coloured figures, post 8vo, 4s. *nett.*

EDWARD WOAKES, M.D. LOND.

Senior Aural Surgeon, London Hospital; Lecturer on Diseases of the Ear, London Hospital Medical College.

ON DEAFNESS, GIDDINESS AND NOISES IN THE HEAD. Fourth Edition, Part i., with Illustrations, 8vo, 10s. 6d.

HENRY WOODS, B.A., F.G.S.

[See Cambridge Biological Series, page 5.

A. S. WOODWARD, M.A.

[See Cambridge Biological Series, page 5.

Lewis's Diet Charts.

Price 5s. per packet of 100 charts (assorted) post free.

A suggestive set of Diet Tables for the use of Physicians, for handing to patients after consultation, modified to suit individual requirements, for Albuminuria, Anæmia and Debility, Constipation, Diabetes, Diarrhœa, Dyspepsia, Eczema, Fevers, Gall Stones, Gout and Gravel, Heart Disease (chronic), Nervous Diseases, Obesity, Phthisis, Rheumatism (chronic), and Blank Chart for other diseases.

A special leaflet on the Diet and Management of Infants is sold separately, price 7s. 6d. per 100, or 1s. per dozen, post free.

Lewis's Handy Temperature Chart.

25s. per 1000, 14s. per 500, 3s. 6d. per 100, 2s. per 50, 1s. per 20, carriage free.

Arranged for three weeks, and specially ruled on back for recording observations on Urine.

Lewis's Four-Hour Temperature Chart.

25s. per 1000, 14s. per 500, 3s. 6d. per 100, 2s. per 50, 1s. per 20, carriage free.

This form has been drawn up to meet the requirements of a chart on which the temperature and other observations can be recorded at intervals of four hours. They will be found most convenient in hospital and private practice. Each chart will last a week.

Lewis's Blood Pressure and Pulse Chart.

25s. per 1000; 14s. per 500; 3s. 6d. per 100; 2s. per 50; 1s. per 20, carriage free.

Lewis's Hæmatological Chart.

A new Chart designed for use in Clinical Research, by E. R. Turton, M.D. 50s. per 1000, 28s. per 500, 15s. per 250, 7s. per 100, or 1s. per dozen, carriage free.

Clinical Chart for Temperature Observations, etc.

Arranged by W. Rigden, M.R.C.S. 50s. per 1000, 28s. per 500, 15s. per 250, 7s. per 100, or 1s. per dozen, carriage free.

Each Chart is arranged for four weeks, and is ruled at the back for making notes of Cases. They are convenient in size, and are suitable both for hospital and private practice.

Lewis's Nursing Chart.

25s. per 1000, 14s. per 500, 3s. 6d. per 100, 2s. per 50, or 1s. per 20, post free.

This Chart affords a ready method of recording the progress of the case from day to day. Printed on both sides.

⁂ *Boards to hold any of the above Charts, price* 1s.

Lewis's Clinical Chart, specially designed for use with the Visiting List.

This Temperature Chart is arranged for four weeks and measures 6 × 3 inches. 20s. per 1000, 11s. 6d. per 500, 2s. 6d. per 100, 6d. per dozen, post free.

Chart for Recording the Examination of Urine.

40s. per 1000; 25s. per 500; 15s. per 250; 7s. 6d. per 100; 1s. per 10.

This Chart is designed for the use of Medical Men, Analysts, and others making examinations of the Urine of patients and affords a very ready and convenient method of recording the results of the examination.

LEWIS'S PRACTICAL SERIES.

Under this title a Series of Monographs is published, embracing the various branches of Medicine and Surgery. The volumes are written by well known Hospital Physicians and Surgeons, recognised as authorities in the subjects of which they treat. The works are of a THOROUGHLY PRACTICAL nature, calculated to meet the requirements of the practitioner and student and to present the most recent information in a compact form.

A HANDBOOK OF BACTERIOLOGICAL DIAGNOSIS FOR PRACTITIONERS (including Instructions for the Clinical Examination of the Blood). By W. D'ESTE EMERY, M.D., B.Sc. Lond., Assistant Bacteriologist to the Laboratories of the Royal Colleges of Physicians and Surgeons, London, &c. With 2 Coloured Plates and 33 Illustrations, crown 8vo, 5s. 6d.

DISEASES OF THE NERVOUS SYSTEM: A Handbook for Students and Practitioners. By CHARLES E. BEEVOR, M.D., LOND., F.R.C.P., Physician to the National Hospital for the Paralysed and Epileptic, the Great Northern Central Hospital, and the National Orthopædic Hospital. With Illustrations, crown 8vo, 10s. 6d.

THE TREATMENT OF PULMONARY CONSUMPTION. By VINCENT D. HARRIS, M.D. LOND., F.R.C.P., Physician to the City of London Hospital for Diseases of the Chest, Victoria Park, &c., and E. CLIFFORD BEALE, M.A., M.B. CANTAB., F.R.C.P., Physician to the City of London Hospital for Diseases of the Chest, Victoria Park, &c. Crown 8vo, 10s. 6d.

THE SURGICAL DISEASES OF CHILDREN AND THEIR TREATMENT BY Modern Methods. By D'ARCY POWER, M.A., M.B. Oxon., F.R.C.S. Eng., Surgeon to St. Bartholomew's Hospital, &c. With Illustrations, crown 8vo, 10s. 6d.

DISEASES OF THE NOSE AND THROAT. By F. de HAVILLAND HALL, M.D., F.R.C.P Lond., Physician to the Westminster Hospital, and HERBERT TILLEY, M.D., B.S. Lond., F.R.C.S. Eng., Surgeon to the Throat Hospital, Golden Square, &c. Second edition, with two coloured plates and 80 illustrations, crown 8vo, 10s. 6d.

PUBLIC HEALTH LABORATORY WORK. By HENRY R. KENWOOD, M.B., D.P.H., F.C.S., Professor of Hygiene and Public Health, University College, &c. Third Edition. (Part VII. contributed by W. G. SAVAGE, M D., &c.). With Illustrations, cr. 8vo, 10s. 6d.

MEDICAL MICROSCOPY: A Guide to the use of the Microscope in Medical Practice. By FRANK J. WETHERED, M.D., M.R.C.P., Demonstrator of Practical Medicine in the Middlesex Hospital Medical School, &c. With Illustrations, crown 8vo, 9s.

MEDICAL ELECTRICITY: A Practical Handbook for Students and Practitioners. By H. LEWIS JONES, M.A., M.D., F.R.C.P. Fourth edition, with 168 Illustrations, demy 8vo, 12s. 6d. *nett.*

HYGIENE AND PUBLIC HEALTH. By LOUIS PARKES, M.D., D.P.H. LOND. UNIV., Fellow of the Royal Sanitary Institute, and HENRY R. KENWOOD, M.B., D.P.H., F.C.S., Professor of Hygiene and Public Health, University College. Second Edition, with 88 Illustrations, cr. 8vo, 12s.

MANUAL OF OPHTHALMIC PRACTICE. By C. HIGGENS, F.R.C.S., Ophthalmic Surgeon to Guy's Hospital; Lecturer on Ophthalmology at Guy's Hospital Medical School. Second Edition, revised and edited by A. W. ORMOND, F.R.C.S.E., &c. With Illustrations, cr. 8vo, 7s 6d.

A PRACTICAL TEXTBOOK OF THE DISEASES OF WOMEN. By ARTHUR H. N. LEWERS, M.D. Lond., F.R.C.P. Lond., Senior Obstetric Physician to the London Hospital, etc. Sixth Edition, with Illustrations, crown 8vo, 10s. 6d.

ANÆSTHETICS: Their Uses and Administration. By DUDLEY W. BUXTON, M.D., B.S., M.R.C.P., Administrator of Anæsthetics and Lecturer in University College Hospital, &c. Fourth Edition, with Illustrations, crown 8vo. [*Nearly ready.*

ON FEVERS: Their History, Etiology, Diagnosis, Prognosis, and Treatment. By ALEXANDER COLLIE, M.D. Aberd., M.R.C.P. Illustrated with Coloured Plates, crown 8vo, 8s. 6d.

HANDBOOK OF DISEASES OF THE EAR: For the Use of Students and Practitioners. By URBAN PRITCHARD, M.D. Edin., F.R.C.S. Eng., Professor of Aural Surgery at King's College, London. Fourth Edition, with Illustrations, crown 8vo. [*In preparation.*

A PRACTICAL TREATISE ON DISEASES OF THE KIDNEYS AND Urinary Derangements. By C. H. RALFE, M.A., M.D., F.R.C.P., Assistant Physician to the London Hospital, &c. With Illustrations, cr. 8vo, 10s. 6d.

DENTAL SURGERY FOR MEDICAL PRACTITIONERS AND STUDENTS of Medicine. By ASHLEY W. BARRETT, M.B. Lond., M.R.C.S., L.D.S., Consulting Dental Surgeon to the London Hospital. Fourth edition, with Illustrations, cr. 8vo, 3s. 6d.

PRACTICAL DEFORMITIES AND THEIR TREATMENT. A Handbook of Practical Orthopædics. By H. A. REEVES, F.R.C.S. Edin., Senior Assistant Surgeon at the London Hospital, etc. With Illustrations, cr. 8vo, 8s. 6d.

THE NEW SYDENHAM SOCIETY'S PUBLICATIONS.

President:—W. Osler, M.D., LL.D., F.R.S.
Honorary Secretary:—Jonathan Hutchinson, Esq., F.R.S.
Treasurer:—Henry Power, Esq., F.R.C.S.
Acting Secretary.—A. E. Russell, M.D., 9 Wimpole Street, W.

ANNUAL SUBSCRIPTION, ONE GUINEA.

The Society is now issuing an important "Atlas of Clinical Medicine, Surgery, and Pathology," designed to form a pictorial guide to diagnosis. A volume of Selected Monographs, or a translation of some important Continental work, will be issued from time to time.

Amongst the works issued are Limbeck's "Pathology of the Blood," Helferich "On Fractures and Dislocations," Laveran's "Paludism," Pozzi's "Gynecology," Spiegelberg's "Midwifery," works by Charcot, Duchenne, Begbie, Billroth, Graves, Koch, Hebra, Guttmann, and a valuable and exhaustive "Lexicon of Medicine and the Allied Sciences," just completed.

All further information will be sent on application to the Acting Secretary, or to the Agent, Mr. Lewis.

PERIODICAL WORKS PUBLISHED BY H. K. LEWIS.

THE BRITISH JOURNAL OF DERMATOLOGY. Under the direction of H. G. Brooke, H. Radcliffe-Crocker, T. Colcott Fox, J. Galloway, E. Graham Little, Sir Stephen Mackenzie, Malcolm Morris, J. J. Pringle, J. H. Sequeira, A. Shillitoe, E. Stainer, J. Herbert Stowers, Arthur Whitfield; Edited by J. M. H. MacLeod. Published monthly, 1s. Annual Subscription, 12s. post free.

THE GLASGOW MEDICAL JOURNAL. Edited by John Lindsay Steven, M.D., and T. K. Monro, M.D. Published Monthly. Annual Subscription, 20s., post free. Single numbers, 2s. each.

LIVERPOOL MEDICO-CHIRURGICAL JOURNAL, including the Proceedings of the Liverpool Medical Institution. Published twice yearly, 3s. 6d. each number.

NORTH LONDON OR UNIVERSITY COLLEGE HOSPITAL REPORTS, SURGICAL CASES. 1901, 8vo, 3s. 6d. *nett.*

THE THERAPEUTIC GAZETTE. A Monthly Journal, devoted to the Science of Pharmacology, and to the introduction of New Therapeutic Agents. Edited by Dr. H. A. Hare and Dr. E. Martin. Annual Subscription, 10s., post free.

MIDDLESEX HOSPITAL, REPORTS OF THE MEDICAL, SURGICAL, AND PATHOLOGICAL REGISTRARS. Demy 8vo, 2s. 6d. *nett.* each volume.

⁂ Mr. Lewis is in constant communication with the leading publishing firms in America, and has transactions with them for the sale of his publications in that country. Advantageous arrangements are made in the interests of Authors for the publishing of their works in the United States.

Mr. Lewis's publications can be procured of all Booksellers in any part of the world.

London: Printed by H. K. Lewis, 136 Gower Street, W.C.